United States Department of Agriculture

Natural Resources Conservation Service

United States Department of the Interior

National Park Service

Soil Survey of Gauley River National Recreation Area, West Virginia

How To Use This Soil Survey

General Soil Map

The general soil map, which is a color map, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

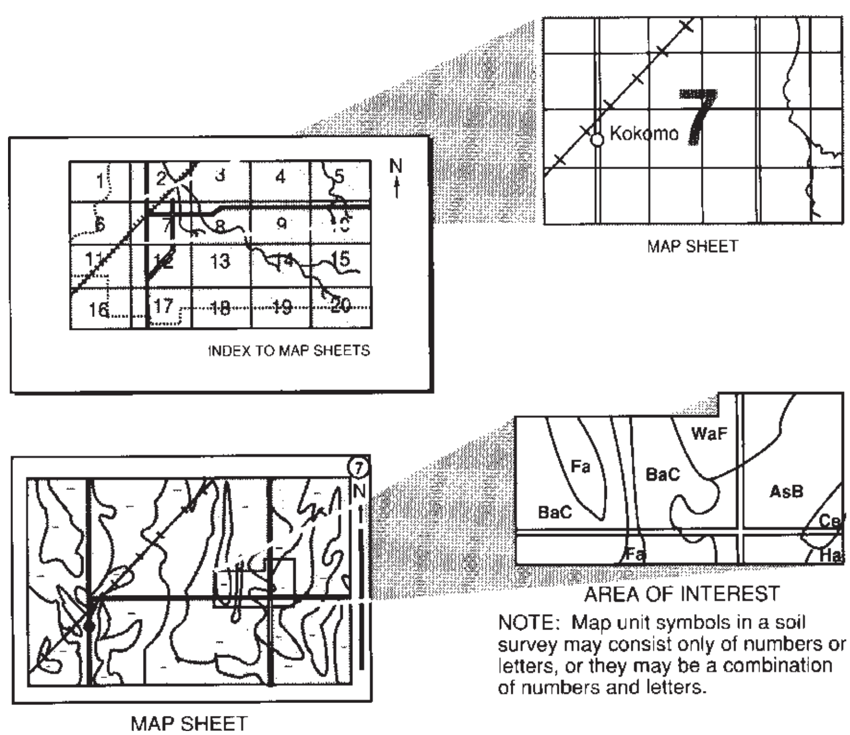
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet and turn to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

National Cooperative Soil Survey

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

The soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, the maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Literature Citation

The correct citation for this survey is as follows:

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Cover Caption

Cliffs formed by the Lower Nuttall sandstone. These cliffs make up the Rock outcrop component of map unit LmF (Layland-Rock outcrop complex, 35 to 70 percent slopes, very rubbly).

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov/.

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Issued 2013

Preface

This soil survey was developed in conjunction with the National Park Service's Soil Inventory and Monitoring Program and is intended to serve as the official source document for soils occurring within Gauley River National Recreation Area, West Virginia.

This soil survey contains information that affects current and future land use planning in the park. It contains predictions of soil behavior for selected land uses. The survey highlights soil limitations, actions needed to overcome the limitations, and the impact of selected land uses on the environment. It is designed to meet the needs of the National Park Service and its partners to better understand the properties of the soils in the park and the effects of these soil properties on various natural ecological characteristics. This knowledge can help the National Park Service and its partners to understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each map unit is shown on the detailed soil maps. Each soil in the survey area is described, and information on specific uses is given. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the National Park Service headquarters in Glen Jean, West Virginia.

Soil Survey of Gauley River National Recreation Area, West Virginia

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Technical support and quality assurance by Susan Southard, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service, and United States Department of the Interior, National Park Service

Gauley River National Recreation Area is located in parts of Nicholas and Fayette Counties, West Virginia (fig. 1). This park was created in 1988 and encompasses over 11,000 acres of land along the Gauley and Meadow Rivers. The 25 miles of the free-flowing Gauley River and the 6 miles of the Meadow River pass through scenic gorges and valleys containing a wide variety of natural and cultural features. The Gauley River contains several class V+ rapids, making it one of the most adventurous whitewater boating rivers in the East.

General Nature of the Survey Area

This section provides general information about the survey area. It discusses the history, environment, and climate of Gauley River National Recreation Area.

History

The Gauley River flows through some of the most rugged terrain in central West Virginia. Settlement of the area began in the 1770s. This led to increasing tension with the Native Americans living in the area. In 1792, two young daughters of Henry Morris were killed while going to herd cows near their home in Lockwood. A militia was raised, but no trace of the attackers was ever found. This was one of the last attacks by Native Americans in the area, but this would not be the last blood spilled along the Gauley.

In September 1861, the Civil War's Battle of Carnifex Ferry was fought (fig. 2). Union troops engaged Confederate soldiers and forced them to evacuate an entrenched position on the Henry Patterson Farm, which overlooked the ferry. The Confederates retreated across the river and fell back, following the Meadow River upstream to Meadow Bluff near Lewisburg. The battle represented the failure of a Confederate drive to regain control of the Kanawha Valley. As a result, the movement for West Virginia statehood proceeded without serious threat from the Confederates.

In the late 1800s, timber cutting began on a large scale. This led to the establishment of railroad lines throughout the survey area. In the early 1900s, the great expansion of the coal industry led to further expansion of the rail lines.

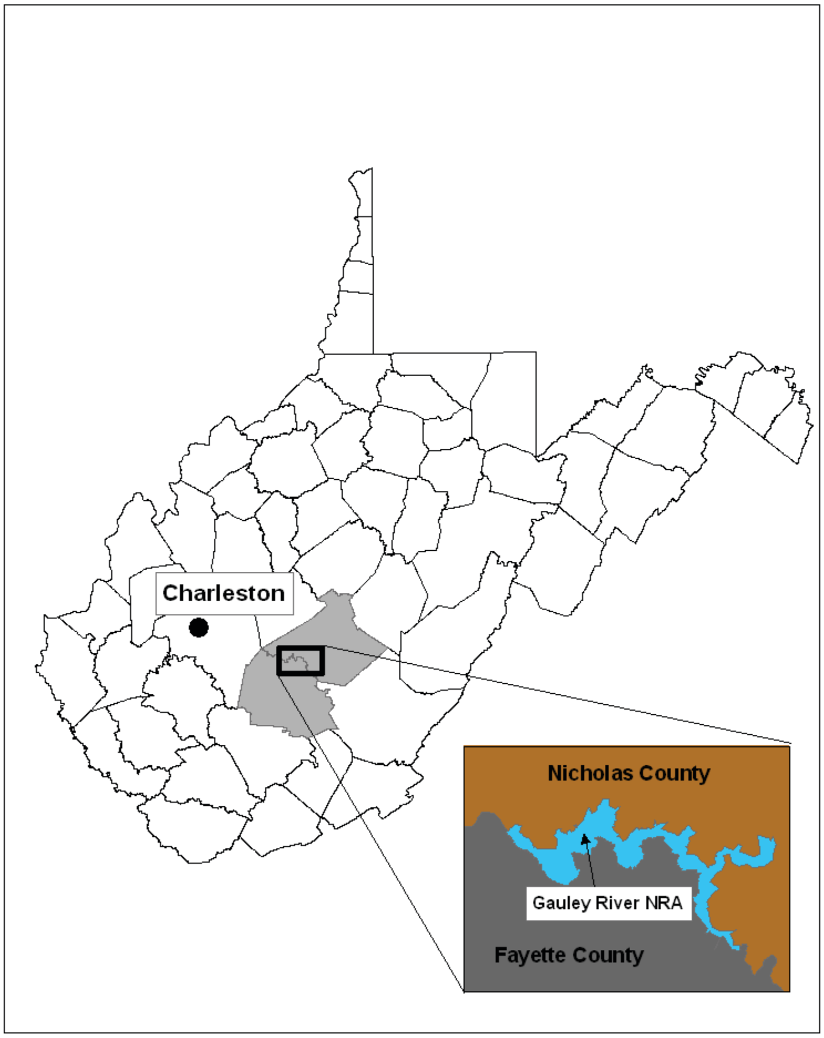

Figure 1.—Location of Gauley River National Recreation Area near Summersville, West Virginia.

In 1905, the Cherry River Paper Company, the William F. Mosser Company (a tannery), and other industries began operations at Richwood. This led to 21 years of industrial pollution in the Gauley River. The pollution became so bad that the river became known as the River of Ink. In 1927, the West Virginia State Wildlife League successfully obtained funds to clean up the river.

By 1965, Summersville Dam was completed. The dam controlled flooding downstream and created Summersville Lake. The lake boasts 51 miles of shoreline and is a popular location for boaters and fishing enthusiasts. The lake also helps support the whitewater rafting industry. Over 60,000 whitewater enthusiasts come to the Gauley River every fall to paddle what is considered by many to be the one of the best whitewater rivers in the country. Gauley Season begins the first weekend after Labor Day and continues for 6 weekends. The Gauley River drops more than 668 feet through 28 miles of rugged terrain. This complex stretch of whitewater features more than 100 rapids with a steep gradient, technical runs, and an incredible volume of water, which produce huge waves. This river's vigorous rapids, scenic quality, and remote location combine to make it one of the premier whitewater runs in the world (http://www.nps.gov/gari/historyculture/index.htm).

Figure 2.—A view of the confluence of the Gauley and Meadow Rivers near the site of Carnifex Ferry.

Environment

The Gauley River Basin is part of the unglaciated Allegheny Plateau where the age of the rock strata exceeds 300 million years. The high knobs and ridges are deeply dissected by streams that create narrow canyons with steep slopes.

The Gauley River begins in Pocahontas County, West Virginia, at an elevation of about 4,600 feet. It flows generally west-southwest and drains 1,422 square miles. The Gauley meets the New River at Gauley Bridge and forms the Kanawha River, a major tributary of the Ohio River. Downstream from Summersville Dam, where the boundary of the recreation area begins, the river has cut a gorge which is 500 feet deep. The Gauley River flows through the gorge for approximately 24 miles with a stream gradient of 28 feet per mile. Within the gorge, the river is characterized by alternating pools and rapids with torrential water, boulders, and exposed bedrock.

Vegetation is diverse and abundant. Extremes in topography, elevation, and microclimate have caused tremendous variation in plant life. Most of the recreation area is below 2,000 feet in elevation and forested. The forest cover is classified as the central hardwood forest type. Tree species in this forest type include northern red oak, white oak, American beech, yellow-poplar, hemlock, and dogwood. The diverse vegetation supports a wide variety of wildlife species.

Rare and threatened species inhabit the recreation area. They include one federally threatened plant species (Virginia spiraea) and five category 2 species (Barbara's buttons, Allegheny woodrat, cerulean warbler, eastern hellbender, and finescale saddled darter). Category 2 species may be proposed for threatened or endangered status, but more data is required to confirm the need for such protection. State-listed species of concern found within the recreation area include nine plant, one bird, one butterfly, one fish, and two amphibian species (http://www.nps.gov/gari/naturescience/index.htm).

Climate

Weather in the Gauley River area is seasonal, and the climate generally mild. Winter can bring significant snowfall, but it is usually short-lived. Summers can be warm and humid.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Summersville Lake in the period 1971 to 2000. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter, the average temperature is 0.05 degree C (32.1 degrees F) and the average daily minimum temperature is -5.38 degrees C (22.3 degrees F). The lowest temperature on record, which occurred at Summersville Lake on January 21, 1985, is -28.8 degrees C (-20 degrees F). In summer, the average temperature is 20.4 degrees C (68.8 degrees F) and the average daily maximum temperature is 26.4 degrees C (79.6 degrees F). The highest recorded temperature, which occurred at Summersville Lake on August 16, 1988, is 34.4 degrees C (94 degrees F).

Growing degree days are shown in table 1. They are equivalent to “heat units.” During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (4.4 degrees C or 40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The average annual total precipitation is 1,207 millimeters (47.52 inches). Of this, 668.8 millimeters (26.33 inches), or about 55 percent, usually falls in May through October. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 131 millimeters (5.16 inches), recorded at Summersville Lake on July 2, 1986. Thunderstorms occur on about 46 days each year, and most occur in July.

The average seasonal snowfall is 1,094.4 millimeters (43.1 inches). The greatest snow depth at any one time during the period of record was 482.6 millimeters (19 inches), recorded on January 1, 1968. On an average, 36 days per year have at least 25.4 millimeters (1 inch) of snow on the ground. The heaviest 1-day snowfall on record (the famous Storm of the Century) was 381 millimeters (15 inches), recorded on March 12, 1993.

The average relative humidity in mid-afternoon is about 57 percent. Humidity is higher at night, and the average at dawn is about 81 percent. The sun shines 57 percent of the time in summer and 36 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 7.1 miles per hour, in March.

How This Survey Was Made

This survey was made in conjunction with the National Park Service’s Soil Inventory and Monitoring Program to provide information about the soils and miscellaneous areas within Gauley River National Recreation Area. A scoping meeting was held in 2006 with park staff to identify their soil resource information needs and to relate those needs to the existing soil survey. Of particular importance to park staff was information regarding management of the land for recreation, forest health, historical significance, wildlife, and watershed planning.

The Gauley River National Recreation Area soil survey was initiated in 2006. It includes part of two existing soil surveys: the soil survey of Fayette and Raleigh Counties, West Virginia and the soil survey of Nicholas County, West Virginia. Fieldwork for the project commenced in 2007 and ended in 2010 and concentrated on areas of concern pointed out by park staff. In some instances, because data was clipped from more than one county-based set of soil maps, some same-named detailed soil map units may have more than one map symbol and their properties may vary.

Figure 3.—Soil scientists use amoozemeters to collect field data on saturated hydraulic conductivity.

During the soil survey, soil component relationships were observed and soil-site correlation concepts were established to help in designing the map units. Soil and plant specialists tested the concepts during mapping and collected field documentation at numerous points across the landscape.

The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were

Figure 4.—Soil scientists preparing soil samples for bulk density analysis.

formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils (fig. 3). After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units).

Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil Taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests (fig. 4). Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they applied knowledge of soil-landscape relationships and used remote-sensing tools, including slope analysis and three-dimensional modeling, to delineate the boundaries of these bodies on digital imagery. They identified each of these bodies as a specific map unit.

General Soil Map Units

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one map unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

1. Rubble land-Pope-Cottonbend

Rubble land and nearly level to strongly sloping, well drained soils that formed in alluvium washed from acid upland soils; on flood plains and terraces of the Gauley and Meadow Rivers

In this map unit, the landscape is characterized by a narrow, rugged riparian zone along the swift-flowing Gauley and Meadow Rivers and a broad, ancient alluvial terrace high above the Gauley River. The riparian zone is commonly covered with boulders and stones. The alluvial parent materials that form the soils in this map unit have washed from upland soils that are acid. Slopes range from 0 to 15 percent.

This map unit makes up about 8 percent of the survey area. It is about 35 percent Rubble land, 25 percent Pope soils, 10 percent Cottonbend soils, and 30 percent soils and miscellaneous areas of minor extent.

The Rubble land consists of sandstone boulders and stones which have toppled into the riparian zone from the nearly continuous line of sheer cliffs along the valley walls of the gorges of the Gauley and Meadow Rivers. Many of the boulders are huge, commonly the size of a house. The boulders and stones have formed the rapids for which the Gauley and Meadow Rivers are famous. Most areas of Rubble land support little or no vegetation because there is no soil development.

The Pope soils are very deep, well drained, and nearly level. They are on small, narrow flood-plain bottoms along the rivers and along Peters Creek. The soils are subject to occasional or rare flooding. They formed in medium to coarse textured, acid alluvium. They have a dark brown, coarse textured surface horizon; a yellowish brown to strong brown, coarse textured subsoil that is weakly developed; and a yellowish brown, coarse textured substratum that has a high rock fragment content. They have medium natural fertility but, because of their relatively coarse textures, have a low water-holding capacity which limits their productivity.

The Cottonbend soils are very deep, well drained, and gently sloping to strongly sloping. They only occur on a terrace high above the Gauley River at a site known as Koontz Bend. Kootz Bend, an ancient landform, was the flood plain of the Gauley River eons ago. The Gauley River flood plain is presently almost 200 feet lower in elevation than site of the Cottonbend soils. The geologic strata under the site are dominated by the massive Lower Nuttall sandstone, a very hard bedrock that is resistant to weathering. It took a very long time for the Gauley River to cut 200 feet through this stratum to its present elevation. Cottonbend soils formed in medium to coarse textured alluvium. They have a thick, dark brown, medium textured surface horizon and a medium textured, well developed subsoil that grades from strong brown to red. Because these soils are very old and weathered, they have low natural fertility.

The minor components of this map unit include Craigsville and Allegheny soils and Typic Haplorthods. The very deep, well drained Craigsville soils are intermingled on the landscape with the Pope soils. They most commonly occur on the margins of the outside bends of rivers and on small islands. The very deep, well drained Allegheny soils are on the Koontz Bend terrace. The very deep, well drained Typic Haplorthods are on an island in the Meadow River under a heavy canopy of eastern hemlock and rhododendron. Also included are small areas of Riverwash, which exhibit little soil development and support little or no vegetation, and Water (the Gauley and Meadow Rivers).

Most of this map unit is forested. A few areas that were cleared and used for agriculture in the past have reverted back to forest. Areas of the Pope and Cottonwood soils and minor Craigsville soils are classified as prime farmland. The main soil limitations are the boulders and stones and flooding in the riparian zone.

2. Highsplint-Berks-Clifftop

Moderately steep to very steep, well drained soils that formed in materials derived from the Kanawha Formation of the Pottsville Group

In this map unit, the landscape is characterized by rugged, steep and very steep mountain slopes with narrow ridgetops and moderately steep and steep footslopes. It is underlain by interbedded layers of siltstone, shale, sandstone, coal, and thin beds of limestone (members of the Kanawha Formation). The soils are in the Gauley River gorge and on surrounding uplands in the western part of the survey area. They generally have medium natural fertility and, under good management, are capable of producing high-quality timber. Slopes range from 15 to 80 percent.

This map unit makes up about 28 percent of the survey area. It is about 30 percent Highsplint soils, 23 percent Berks soils, 15 percent Clifftop soils, and 32 percent soils of minor extent.

The Highsplint soils are very deep, well drained, and moderately steep to very steep. They formed in colluvium derived from interbedded shale, siltstone, and sandstone and are on linear to concave portions of backslopes. The soils have a very dark grayish brown to dark yellowish brown, medium textured surface horizon and a yellowish brown to dark yellowish brown, medium textured subsoil that is weakly developed and has a relatively high rock fragment content.

The Berks soils are moderately deep, well drained, and very steep. They formed in residuum derived from interbedded shale, siltstone, and sandstone. The soils are on convex portions of backslopes. They have a thin, dark brown to dark yellowish brown, medium textured surface horizon and a yellowish brown, medium textured subsoil that is weakly developed and has a high rock fragment content. Hard bedrock is at a depth of 51 to 102 centimeters (20 to 40 inches). Because of the high rock fragment content, these soils have a low water-holding capacity which limits their productivity.

The Clifftop soils are moderately deep, well drained, and moderately steep or steep. They formed in acid residuum derived mainly from interbedded shale and

siltstone. The soils are on linear to convex portions of backslopes. They have a brown to dark yellowish brown, medium textured surface layer and a yellowish brown to strong brown, medium textured, well developed subsoil that has been enriched with translocated clay. Weathered bedrock is at a depth of 51 to 102 centimeters (20 to 40 inches).

The minor components of this map unit include Sharondale and Dekalb soils. The very deep, well drained Sharondale soils formed in colluvium and are in cool, north-facing mountain coves. These soils have thick, dark brown surface horizons and high natural fertility. This allows them to support abundant and diverse flora, including excellent stands of hardwood trees. The moderately deep, well drained Dekalb soils are on narrow ridgetops which are underlain by acid sandstone.

This map unit is forested. It contains no areas of prime farmland. The main soil limitations are the slope, slippage potential, and depth to bedrock.

3. Layland-Laidig-Rock outcrop

Very steep and steep, well drained soils that formed in materials derived from the New River Formation of the Pottsville Group and areas of Rock outcrop; on backslopes and footslopes of the gorges of the Gauley and Meadow Rivers

In this map unit, the landscape is characterized by very steep, rugged backslopes and steep footslopes of the gorges of the Gauley and Meadow Rivers. It is underlain by interbedded layers of sandstone, shale, siltstone, and coal of the New River Formation. Sandstone cliffs formed by the Lower Nuttall sandstone are a prominent feature of this landscape. Below the Lower Nuttall cliffs, stones and boulders cover up to 90 percent of the soil surface. The soils are acid have low natural fertility. Slopes range from 3 to 35 percent on the footslopes and up to 70 percent on the very steep backslopes of the river gorges.

This map unit makes up about 51 percent of the survey area. It is about 56 percent Layland soils, 17 percent Laidig soils, 6 percent Rock outcrop, and 21 percent soils and miscellaneous areas of minor extent.

The Layland soils are very deep and well drained. They are on very steep, slightly convex to linear portions of backslopes above the Lower Nuttall cliffs and on moderately steep, linear portions of footslopes below the cliffs. The soils formed in acid colluvium derived mainly from interbedded sandstone, shale, and siltstone. Where these soils occur above the Lower Nuttall cliffs, 1 to 50 percent of the surface is covered by stones. Below the cliffs, 50 to 90 percent of the surface is covered with stones and large boulders. The soils have a very dark grayish brown to brown, medium textured surface layer and a yellowish brown, medium textured subsoil that is weakly developed. These soils have a high content of sandstone stones, cobbles, and channers which generally increase in amount as depth increases.

The Laidig soils are very deep and well drained. They are on steep, linear to concave portions of backslopes above the Lower Nuttall cliffs and on gently sloping to moderately steep, concave footslopes below the cliffs. The soils formed in acid colluvium derived mainly from interbedded sandstone, shale, and siltstone. Where these soils occur above the Lower Nuttall cliffs, 1 to 50 percent of the surface is covered by stones. Below the cliffs, 50 to 90 percent of the surface is covered with stones and large boulders. The soils have a very dark grayish brown, medium textured surface layer and a yellowish brown, medium textured, well developed subsoil that has been enriched with translocated clay. In the lower part of the subsoil, below a depth of 76 centimeters (30 inches), these soils have a very firm, dense layer called a fragipan. This layer is slowly permeable and restricts the passage of plant roots and water through the soil profile.

The Rock outcrop is mainly the outcropping of the Lower Nuttall sandstone, a stratum of the New River Formation. This outcrop forms a nearly continuous line of

sheer cliffs almost 100 feet tall along the backslopes of the gorges of the Gauley and Meadow Rivers. The Lower Nuttall sandstone, as it is expressed in the survey area, is massive, hard, resistant to weathering, and highly siliceous.

The minor soils of this map unit include Dekalb, Clifftop, and Guyandotte soils. The moderately deep, well drained Dekalb soils formed in residuum derived mainly from acid sandstone, are on convex shoulder slopes and backslopes, and are commonly associated with Rock outcrop. The moderately deep, well drained Clifftop soils formed in residuum derived mainly from acid shale and siltstone and are on convex upper backslopes and shoulder slopes, above the Lower Nuttall cliffs. The very deep, well drained Guyandotte soils formed in acid colluvium and are on cool, north-facing slopes.

This map unit is forested. The main limitations of the soils for most uses are the slope, boulders and stones, cliffs (Rock outcrop), a high slippage potential, and the restricted permeability of the Laidig soils.

4. Clifftop-Nallen-Laidig

Gently sloping to moderately steep, well drained soils that formed in materials derived from the Pottsville Group; on summits and footslopes

In this map unit, the landscape is characterized by gently sloping to moderately steep, linear to convex summits and concave footslopes on the uplands surrounding the gorges of the Gauley and Meadow Rivers. It is underlain by interbedded layers of acid sandstone, siltstone, and shale and coal members of both the Kanawha and New River Formations of the Pottsville Group. The soils are acid and have low natural fertility. Slopes range from 3 to 35 percent.

This map unit makes up about 10 percent of the survey area. It is about 41 percent Clifftop soils, 22 percent Nallen soils, 12 percent Laidig soils, and 25 percent soils and miscellaneous areas of minor extent.

The Clifftop soils are moderately deep, well drained, and gently sloping to moderately steep. They formed in acid residuum derived mainly from interbedded shale, siltstone, and fine grained sandstone. The soils are on convex summits and shoulder slopes. They have a brown, medium textured surface layer and a yellowish brown, medium textured, well developed subsoil that has been enriched with translocated clay and has a relatively low rock fragment content. Weathered bedrock is at a depth of 51 to 102 centimeters (20 to 40 inches).

The Nallen soils are moderately deep, well drained, and gently sloping to moderately steep. They formed in residuum derived mainly from acid sandstone. The soils are located on convex summits. They have a very dark grayish brown, medium textured surface layer and a yellowish brown, medium to coarse textured, moderately well developed subsoil that has been slightly enriched with translocated clay and has a relatively low rock fragment content. Bedrock is at a depth of 51 to 102 centimeters (20 to 40 inches).

The Laidig soils are very deep, well drained, and dominantly gently sloping to moderately steep. They formed in acid colluvium derived mainly from interbedded sandstone, shale, and siltstone. The soils are on concave footslopes. They have a very dark grayish brown, medium textured surface layer and a yellowish brown, medium textured, well developed subsoil that has been enriched with translocated clay. In the lower part of the subsoil, below a depth of 76 centimeters (30 inches), the Laidig soils have a very firm, dense layer called a fragipan. This layer is slowly permeable and restricts the passage of plant roots and water through the soil profile.

The minor soils of this map unit include Dekalb, Fenwick, and Buchanan soils. The moderately deep, well drained Dekalb soils are on shoulder slopes and summits. The moderately deep, moderately well drained Fenwick soils are on broad, gently sloping to strongly sloping summits. The very deep, moderately well drained Buchanan soils

are on concave footslopes. Also included are miscellaneous areas of Rock outcrop, which are mostly associated with the Dekalb soils and are common on shoulder slopes.

Most of this map unit is forested. Some areas have been cleared and are used for agriculture or housing or are idle. The main limitations of the soils are the slope, depth to bedrock, surface stoniness, and the restricted permeability of the Laidig soils. Some gently sloping areas of the Clifftop and Nallen soils are classified as prime farmland.

5. Lithic Udorthents-Udorthents

Nearly level to very steep anthropogenic soils that formed in human-transported materials (HTM)

In this map unit, the landscape has been drastically disturbed by humans. The unit includes road and railroad grades and right-of-ways, the spillway of the Summersville Dam, and other areas where the soils and/or underlying bedrock have been excavated or placed as fill material. The parent materials of the soils are highly variable and may consist of one or more of the following materials: excavated and transported native soil materials, the substratum of native soils that have been exposed by excavation, and crushed and weathered bedrock, either of local origin or transported. These soils are young and have not been subjected to the soil-forming processes long enough for distinctive horizons to form; their physical and chemical properties are highly variable. Slopes range from 0 to 100 percent.

This map unit makes up about 3 percent of the survey area. It is about 61 percent Lithic Udorthents, 32 percent Udorthents, and 7 percent miscellaneous areas of minor extent.

The Lithic Udorthents are in areas that have been excavated (cut) without filling. They are most extensive in the area that was excavated for the spillway of the Summersville Dam. The soils are gently sloping to very steep, are typically less than 51 centimeters (20 inches) deep to bedrock, and have a low water-holding capacity.

The Udorthents are in areas that have been disturbed by excavation, grading, filling, dumping, or a combination of these activities. They are used for building sites, road beds, railroad grades, parking lots, and river access areas. The parent material is highly variable but commonly consists of a mixture of native soils and excavated bedrock from local sources. The soils are generally well drained, are deep or very deep to bedrock, and have a high rock fragment content. They are commonly highly compacted by earth-moving machinery.

The minor components of this map unit include areas of Rock outcrop and Urban land. The Rock outcrop has been exposed by excavation and forms highwalls along railroad right-of-ways and road cuts. The Urban land is any area that has been paved (roads) or is otherwise impervious to water.

Many areas of this map unit support non-native plant species. Because the properties of the soils are so variable, an onsite investigation is required to determine their suitability for use and management.

Detailed Soil Map Units

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the park. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. The soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most

of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Allegheny loam, 8 to 15 percent slopes, is a phase of the Allegheny series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Laidig-Clifftop complex, 15 to 35 percent slopes, very stony, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Water is an example.

Table 4 gives the acres, hectares, and proportionate extent of each map unit in the park. Other tables give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

AgC—Allegheny loam, 8 to 15 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 302 to 328 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Allegheny and similar soils: 80 percent
Dissimilar minor components: 20 percent

Description of the Allegheny Soil

Classification
Fine-loamy, mixed, semiactive, mesic Typic Hapludults

Setting
Landform: High stream terraces in river valleys
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 8 to 15 percent
Parent material: Fine-loamy alluvium

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained

Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 26.3 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)
Dominant vegetation map class(es):
Successional (Virginia, Pitch) Pine Forest
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 1 centimeter; slightly decomposed plant material
Oe—1 to 4 centimeters; moderately decomposed plant material
A—4 to 26 centimeters; loam
BE—26 to 42 centimeters; loam
Bt—42 to 165 centimeters; clay loam

Minor Components

Cotaco soils
Percent of map unit: 10 percent
Slope: 8 to 15 percent
Landform: High stream terraces in river valleys of mountains
Hydric soil status: No

Clifftop soils
Percent of map unit: 8 percent
Slope: 8 to 15 percent
Landform: Ridges
Hydric soil status: No

Knowlton soils
Percent of map unit: 2 percent
Slope: 0 to 3 percent
Landform: Depressions on high stream terraces
Hydric soil status: Yes

BhG—Berks-Highsplint-Sharondale complex, 35 to 80 percent slopes, very stony

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 211 to 558 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Berks and similar soils: 35 percent
Highsplint and similar soils: 30 percent

Sharondale and similar soils: 20 percent
Dissimilar minor components: 15 percent

Description of the Berks Soil

Classification
Loamy-skeletal, mixed, active, mesic Typic Dystrudepts

Setting
Landform: Convex mountain slopes
Landform position (two-dimensional): Summit, shoulder, and backslope
Landform position (three-dimensional): Mountaintop and mountain flank
Down-slope shape: Convex
Across-slope shape: Convex
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 35 to 80 percent
Parent material: Residuum weathered from interbedded sedimentary rock, mainly shale members of the Kanawha Formation of the Pottsville Group

Properties and Qualities
Depth to restrictive feature: 51 to 102 centimeters to lithic bedrock
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Moderate (about 7.5 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Oak - Hickory - Sugar Maple Forest
Oak - Hickory Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 2 centimeters; slightly decomposed plant material
A—2 to 19 centimeters; channery silt loam
BA—19 to 28 centimeters; channery silt loam
Bw—28 to 76 centimeters; very channery silt loam
C—76 to 98 centimeters; extremely channery silt loam
R—98 to 108 centimeters; bedrock

Description of the Highsplint Soil

Classification
Loamy-skeletal, mixed, active, mesic Typic Dystrudepts

Setting
Landform: Mountain slopes

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountain flank
Down-slope shape: Linear
Across-slope shape: Concave
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 35 to 80 percent
Parent material: Very stony colluvium derived from interbedded sedimentary rock, mainly members of the Kanawha Formation of the Pottsville Group

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Shrink-swell potential: Low (about 2.1 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 15.8 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Sugar Maple - Yellow Buckeye - American Basswood Forest
Oak - Hickory - Sugar Maple Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 2 centimeters; slightly decomposed plant material
Oe—2 to 4 centimeters; moderately decomposed plant material
A—4 to 22 centimeters; channery loam and very channery loam
BA—22 to 31 centimeters; very channery loam
Bw—31 to 120 centimeters; very channery loam
BC—120 to 140 centimeters; extremely channery loam
C—140 to 165 centimeters; extremely channery loam

Description of the Sharondale Soil

Classification
Loamy-skeletal, mixed, active, mesic Typic Hapludolls

Setting
Landform: North-facing mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountain flank
Down-slope shape: Linear
Across-slope shape: Concave
Aspect (representative): North
Aspect range: Northwest to east (clockwise)
Slope range: 35 to 80 percent

Parent material: Very stony colluvium derived from interbedded sedimentary rock, mainly members of the Kanawha Formation of the Pottsville Group

Properties and Qualities
Depth to restrictive feature: 152 to 251 centimeters to lithic bedrock
Shrink-swell potential: Low (about 2.7 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): High
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 20.0 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Sugar Maple - Yellow Buckeye - American Basswood Forest
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Hydric soil status: No
Hydrologic soil group: A

Representative Profile
Oi—0 to 5 centimeters; slightly decomposed plant material
A—5 to 38 centimeters; channery loam
AB—38 to 51 centimeters; channery loam
Bw—51 to 160 centimeters; very channery loam
BC+C—160 to 218 centimeters; very channery loam
R—218 to 228 centimeters; bedrock

Minor Components

Matewan soils
Percent of map unit: 9 percent
Slope: 35 to 80 percent
Landform: Mountain slopes
Hydric soil status: No

Clifftop soils
Percent of map unit: 5 percent
Slope: 35 to 80 percent
Landform: Convex mountain slopes
Hydric soil status: No

Rock outcrop
Percent of map unit: 1 percent
Landform: Sandstone cliffs
Dominant vegetation map class(es):
Cliff Face
Hydric soil status: No

BuC—Buchanan loam, 8 to 15 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains and 125—Cumberland Plateau and Mountains
Elevation: 238 to 489 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Buchanan and similar soils: 80 percent
Dissimilar minor components: 20 percent

Description of the Buchanan Soil

Classification
Fine-loamy, mixed, semiactive, mesic Aquic Fragiudults

Setting
Landform: Drainageways and footslopes on mountain slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Aspect (representative): South
Aspect range: All aspects
Slope range: 8 to 15 percent
Parent material: Loamy colluvium derived from sandstone and siltstone

Properties and Qualities
Depth to restrictive feature: 51 to 91 centimeters to a fragipan
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately low
Natural drainage class: Moderately well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table (depth, kind): About 41 to 76 centimeters, perched (see table 25)
Available water capacity (entire profile): Very high (about 21.2 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
West Virginia grassland suitability group (WVGSG): Acid Loams (AL2)
Dominant vegetation map class(es):
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Developed Area
Oak - Hickory Forest
Hydric soil status: No
Hydrologic soil group: C

Representative Profile
Oe—0 to 3 centimeters; moderately decomposed plant material
A+E—3 to 20 centimeters; fine sandy loam
Bt—20 to 53 centimeters; channery loam
Btx—53 to 152 centimeters; channery loam
C—152 to 165 centimeters; very channery sandy loam

Minor Components

Laidig soils
Percent of map unit: 10 percent
Slope: 8 to 15 percent
Landform: Drainageways and footslopes on mountain slopes
Hydric soil status: No

Clifftop soils
Percent of map unit: 5 percent
Slope: 8 to 15 percent
Landform: Ridges
Hydric soil status: No

Morehead soils
Percent of map unit: 5 percent
Slope: 0 to 3 percent
Landform: Low stream terraces
Hydric soil status: No

ClB—Clifftop channery silt loam, 3 to 8 percent slopes

Map Unit Setting

Landscape: Mountains (fig. 5)
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 382 to 591 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Clifftop and similar soils: 80 percent
Dissimilar minor components: 20 percent

Description of the Clifftop Soil

Classification
Fine-loamy, mixed, semiactive, mesic Typic Hapludults

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountaintop
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 3 to 8 percent
Parent material: Acid fine-loamy residuum weathered from shale and siltstone

Figure 5.—Hayland in an area of Clifftop channery silt loam, 3 to 8 percent slopes. This map unit qualifies as prime farmland.

Properties and Qualities
Depth to restrictive feature: 51 to 102 centimeters to paralithic bedrock
Shrink-swell potential: Low (about 2.2 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 13.0 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 2e
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)
Dominant vegetation map class(es):
Eastern Hemlock Plateau Forest
Oak - Hickory Forest
Developed Area
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Hydric soil status: No
Hydrologic soil group: C

Representative Profile
Oi—0 to 3 centimeters; slightly decomposed plant material

A—3 to 8 centimeters; channery silt loam
BA—8 to 20 centimeters; silt loam
Bt—20 to 74 centimeters; channery silty clay loam
BC—74 to 91 centimeters; very channery silty clay loam
Cr—91 to 101 centimeters; bedrock

Minor Components

Nallen soils
Percent of map unit: 10 percent
Slope: 3 to 8 percent
Landform: Ridges
Hydric soil status: No

Dekalb soils
Percent of map unit: 5 percent
Slope: 4 to 12 percent
Landform: Ridges
Hydric soil status: No

Cookport soils
Percent of map unit: 3 percent
Slope: 3 to 8 percent
Landform: Broad ridges
Hydric soil status: No

Fenwick soils
Percent of map unit: 2 percent
Slope: 3 to 8 percent
Landform: Broad ridges
Hydric soil status: No

ClC—Clifftop channery silt loam, 8 to 15 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 356 to 591 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Clifftop and similar soils: 80 percent
Dissimilar minor components: 20 percent

Description of the Clifftop Soil

Classification
Fine-loamy, mixed, semiactive, mesic Typic Hapludults

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountaintop
Down-slope shape: Convex
Across-slope shape: Convex

Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 8 to 15 percent
Parent material: Acid fine-loamy residuum weathered from shale and siltstone

Properties and Qualities
Depth to restrictive feature: 51 to 102 centimeters to paralithic bedrock
Shrink-swell potential: Low (about 2.2 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 13.0 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)
Dominant vegetation map class(es):
Eastern Hemlock Plateau Forest
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Oak - Hickory Forest
Developed Area
Hydric soil status: No
Hydrologic soil group: C

Representative Profile
Oi—0 to 3 centimeters; slightly decomposed plant material
A—3 to 8 centimeters; channery silt loam
BA—8 to 20 centimeters; silt loam
Bt—20 to 74 centimeters; channery silty clay loam
BC—74 to 91 centimeters; very channery silty clay loam
Cr—91 to 101 centimeters; bedrock

Minor Components

Nallen soils
Percent of map unit: 10 percent
Slope: 8 to 15 percent
Landform: Ridges
Hydric soil status: No

Dekalb soils
Percent of map unit: 5 percent
Slope: 8 to 15 percent
Landform: Ridges
Hydric soil status: No

Fenwick soils
Percent of map unit: 3 percent
Slope: 8 to 15 percent
Landform: Broad ridges
Hydric soil status: No

Cookport soils
Percent of map unit: 2 percent
Slope: 3 to 8 percent
Landform: Broad ridges
Hydric soil status: No

ClD—Clifftop channery silt loam, 15 to 25 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 319 to 551 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Clifftop and similar soils: 75 percent
Dissimilar minor components: 25 percent

Description of the Clifftop Soil

Classification
Fine-loamy, mixed, semiactive, mesic Typic Hapludults

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountaintop
Down-slope shape: Convex
Across-slope shape: Convex
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 15 to 25 percent
Parent material: Acid fine-loamy residuum weathered from shale and siltstone

Properties and Qualities
Depth to restrictive feature: 51 to 102 centimeters to paralithic bedrock
Shrink-swell potential: Low (about 2.2 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 13.0 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)

Dominant vegetation map class(es):
Eastern Hemlock Plateau Forest
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Oak - Hickory Forest
Developed Area
Hydric soil status: No
Hydrologic soil group: C

Representative Profile
Oi—0 to 3 centimeters; slightly decomposed plant material
A—3 to 8 centimeters; channery silt loam
BA—8 to 20 centimeters; silt loam
Bt—20 to 74 centimeters; channery silty clay loam
BC—74 to 91 centimeters; very channery silty clay loam
Cr—91 to 101 centimeters; bedrock

Minor Components

Nallen soils
Percent of map unit: 10 percent
Slope: 15 to 25 percent
Landform: Ridges
Hydric soil status: No

Dekalb soils
Percent of map unit: 5 percent
Slope: 15 to 25 percent
Landform: Ridges
Hydric soil status: No

Laidig soils
Percent of map unit: 5 percent
Slope: 15 to 35 percent
Landform: Drainageways and footslopes on mountain slopes
Hydric soil status: No

Layland soils
Percent of map unit: 5 percent
Slope: 15 to 25 percent
Landform: Mountain slopes
Hydric soil status: No

ClE—Clifftop channery silt loam, 25 to 35 percent slopes

Map Unit Setting

Landscape: Mountains (fig. 6)
Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 221 to 571 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Clifftop and similar soils: 70 percent
Dissimilar minor components: 30 percent

Figure 6.—A stand of hardwood trees in an area of Clifftop channery silt loam, 25 to 35 percent slopes.

Description of the Clifftop Soil

Classification
Fine-loamy, mixed, semiactive, mesic Typic Hapludults

Setting
Landform: Convex mountain slopes
Landform position (three-dimensional): Mountain flank
Down-slope shape: Linear
Across-slope shape: Convex
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 25 to 35 percent
Parent material: Acid fine-loamy residuum weathered from shale and siltstone

Properties and Qualities
Depth to restrictive feature: 51 to 102 centimeters to paralithic bedrock (fig. 7)
Shrink-swell potential: Low (about 2.2 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None

Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 13.0 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 6e
West Virginia grassland suitability group (WVGSG): Acid Hills (AH3)
Dominant vegetation map class(es):
Oak - Hickory Forest
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Oak - Hickory - Sugar Maple Forest
Sugar Maple - Yellow Buckeye - American Basswood Forest Eastern Hemlock Plateau Forest
Hydric soil status: No
Hydrologic soil group: C

Representative Profile
Oi—0 to 3 centimeters; slightly decomposed plant material
A—3 to 8 centimeters; channery silt loam
BA—8 to 20 centimeters; silt loam
Bt—20 to 74 centimeters; channery silty clay loam
BC—74 to 91 centimeters; very channery silty clay loam
Cr—91 to 99 centimeters; bedrock

Figure 7.—A tree throw in an area of Clifftop channery silt loam, 25 to 35 percent slopes. Because the bedrock limits rooting depth, tree throws are common in areas of moderately deep soils on steep slopes.

Minor Components

Nallen soils
Percent of map unit: 15 percent
Slope: 25 to 35 percent
Landform: Mountain slopes
Hydric soil status: No

Dekalb soils
Percent of map unit: 10 percent
Slope: 25 to 45 percent
Landform: Mountain slopes
Hydric soil status: No

Layland soils
Percent of map unit: 5 percent
Slope: 25 to 35 percent
Landform: Mountain slopes
Hydric soil status: No

CmC—Clifftop channery silt loam, 3 to 15 percent slopes, very stony

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 321 to 455 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Clifftop and similar soils: 75 percent
Dissimilar minor components: 25 percent

Description of the Clifftop Soil

Classification
Fine-loamy, mixed, semiactive, mesic Typic Hapludults

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountaintop
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 3 to 15 percent
Parent material: Acid fine-loamy residuum weathered from shale and siltstone

Properties and Qualities
Depth to restrictive feature: 51 to 102 centimeters to paralithic bedrock
Shrink-swell potential: Low (about 2.2 LEP)

Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 13.0 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 6s
West Virginia grassland suitability group (WVGSG): Very Rocky, Acid Soils (RA3)
Dominant vegetation map class(es):
Oak - Hickory Forest
Hydric soil status: No
Hydrologic soil group: C

Representative Profile
Oi—0 to 3 centimeters; slightly decomposed plant material
A—3 to 8 centimeters; channery silt loam
BA—8 to 20 centimeters; silt loam
Bt—20 to 74 centimeters; channery silty clay loam
BC—74 to 91 centimeters; very channery silty clay loam
Cr—91 to 101 centimeters; bedrock

Minor Components

Dekalb soils
Percent of map unit: 10 percent
Slope: 3 to 15 percent
Landform: Ridges
Dominant vegetation map class(es):
Oak / Ericad Forest
Hydric soil status: No

Cookport soils
Percent of map unit: 5 percent
Slope: 3 to 8 percent
Landform: Broad ridges
Hydric soil status: No

Fenwick soils
Percent of map unit: 5 percent
Slope: 3 to 8 percent
Landform: Broad ridges
Hydric soil status: No

Nallen soils
Percent of map unit: 5 percent
Slope: 3 to 15 percent
Landform: Ridges
Hydric soil status: No

CwB—Cottonbend loam, 3 to 8 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 342 to 349 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Cottonbend and similar soils: 90 percent
Dissimilar minor components: 10 percent

Description of the Cottonbend Soil

Classification
Fine-loamy, siliceous, semiactive, mesic Typic Paleudults

Setting
Landform: High stream terraces in river valleys of mountains
Landform position (three-dimensional): Tread
Down-slope shape: Linear and convex
Across-slope shape: Linear and convex
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 3 to 8 percent
Parent material: Very old alluvium derived from sedimentary rock

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 25.5 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 2e
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)
Dominant vegetation map class(es):
Successional (Virginia, Pitch) Pine Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 1 centimeter; slightly decomposed plant material
A—1 to 8 centimeters; loam
Ap—8 to 20 centimeters; loam

Bt1—20 to 61 centimeters; loam
Bt2+Bt3—61 to 102 centimeters; loam
Bt4—102 to 128 centimeters; loam
Bt5—128 to 200 centimeters; loam

Minor Components

Clifftop soils
Percent of map unit: 5 percent
Slope: 3 to 8 percent
Landform: Ridges
Hydric soil status: No

Cotaco soils
Percent of map unit: 5 percent
Slope: 3 to 8 percent
Landform: High stream terraces in river valleys of mountains
Hydric soil status: No

CwC—Cottonbend loam, 8 to 15 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 325 to 359 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Cottonbend and simlar soils: 90 percent
Dissimilar minor components: 10 percent

Description of the Cottonbend Soil

Classification
Fine-loamy, siliceous, semiactive, mesic Typic Paleudults

Setting
Landform: High stream terraces in river valleys of mountains
Landform position (three-dimensional): Tread
Down-slope shape: Linear and convex
Across-slope shape: Linear and convex
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 8 to 15 percent
Parent material: Very old alluvium derived from sedimentary rock

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 25.5 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)
Dominant vegetation map class(es):
Successional (Virginia, Pitch) Pine Forest
Eastern Hemlock Plateau Forest
Successional Tuliptree Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 1 centimeter; slightly decomposed plant material
A—1 to 8 centimeters; loam
Ap—8 to 20 centimeters; loam
Bt1—20 to 61 centimeters; loam
Bt2+Bt3—61 to 102 centimeters; loam
Bt4—102 to 128 centimeters; loam
Bt5—128 to 200 centimeters; loam

Minor Components

Clifftop soils
Percent of map unit: 5 percent
Slope: 8 to 15 percent
Landform: Ridges
Hydric soil status: No

Cotaco soils
Percent of map unit: 5 percent
Slope: 8 to 15 percent
Landform: High stream terraces in river valleys of mountains
Hydric soil status: No

DkC—Dekalb very channery loam, 3 to 15 percent slopes, extremely stony

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 327 to 603 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Dekalb and similar soils: 80 percent
Dissimilar minor components: 20 percent

Description of the Dekalb Soil

Classification
Loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountaintop
Down-slope shape: Convex
Across-slope shape: Convex
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 3 to 15 percent
Parent material: Acid loamy residuum weathered from sandstone

Properties and Qualities
Depth to restrictive feature: 51 to 102 centimeters to lithic bedrock
Shrink-swell potential: Low (about 2.1 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): High
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Moderate (about 8.1 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Very Rocky, Acid Soils (RA3)
Dominant vegetation map class(es):
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Eastern Hemlock Plateau Forest
Oak - Hickory Forest
Hydric soil status: No
Hydrologic soil group: A

Representative Profile
Oi—0 to 1 centimeter; slightly decomposed plant material
Oe—1 to 3 centimeters; moderately decomposed plant material
A—3 to 8 centimeters; highly organic very channery sandy loam
BA—8 to 20 centimeters; very channery sandy loam
Bw—20 to 65 centimeters; very channery loam
BC—65 to 80 centimeters; extremely channery loam

Minor Components

Fenwick soils
Percent of map unit: 10 percent
Slope: 3 to 15 percent
Landform: Broad ridges
Hydric soil status: No

Nallen soils
Percent of map unit: 10 percent

Slope: 3 to 15 percent
Landform: Ridges
Hydric soil status: No

DrE—Dekalb-Rock outcrop complex, 15 to 35 percent slopes, extremely stony

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 331 to 610 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Dekalb and similar soils: 55 percent
Rock outcrop: 15 percent
Dissimilar minor components: 30 percent

Description of the Dekalb Soil

Classification
Loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts

Setting
Landform: Mountain slopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Upper third of mountain flank
Down-slope shape: Convex
Across-slope shape: Convex
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 15 to 35 percent
Parent material: Acid loamy residuum weathered from sandstone

Properties and Qualities
Depth to restrictive feature: 51 to 102 centimeters to lithic bedrock
Shrink-swell potential: Low (about 2.1 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): High
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Moderate (about 8.1 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)

Dominant vegetation map class(es):
Oak - Hickory Forest
Oak - Hickory - Sugar Maple Forest
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Hydric soil status: No
Hydrologic soil group: A

Representative Profile
Oi—0 to 1 centimeter; slightly decomposed plant material
Oe—1 to 3 centimeters; moderately decomposed plant material
A—3 to 8 centimeters; highly organic very channery sandy loam
BA—8 to 20 centimeters; very channery sandy loam
Bw—20 to 65 centimeters; very channery loam
BC—65 to 80 centimeters; extremely channery loam
R—80 to 90 centimeters; bedrock

Description of Rock Outcrop

Setting
Landform: Sandstone cliffs
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Mountain flank
Aspect (representative): Southwest
Aspect range: All aspects
Parent material: Sandstone

Interpretive Groups
Land capability subclass (nonirrigated): 8s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Cliff Face
Hydric soil status: No

Minor Components

Clifftop soils
Percent of map unit: 10 percent
Slope: 25 to 35 percent
Landform: Convex mountain slopes
Hydric soil status: No

Nallen soils
Percent of map unit: 10 percent
Slope: 25 to 35 percent
Landform: Mountain slopes
Hydric soil status: No

Layland soils
Percent of map unit: 5 percent
Slope: 15 to 35 percent
Landform: Areas below rock outcrop on mountain slopes
Dominant vegetation map class(es):
Oak / Great Laurel Forest
Hydric soil status: No

Totz soils
Percent of map unit: 5 percent
Slope: 3 to 25 percent

Landform: Areas near rock outcrop on mountain slopes
Dominant vegetation map class(es):
Cliff Top Virginia Pine Forest
Hydric soil status: No

FeB—Fenwick silt loam, 3 to 8 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 411 to 530 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Fenwick and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of the Fenwick Soil

Classification
Fine-loamy, mixed, semiactive, mesic Aquic Hapludults

Setting
Landform: Broad ridges
Landform position (three-dimensional): Mountaintop
Down-slope shape: Convex
Across-slope shape: Convex
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 3 to 8 percent
Parent material: Residuum weathered from sandstone and shale

Properties and Qualities
Depth to restrictive feature: 51 to 109 centimeters to lithic bedrock
Shrink-swell potential: Low (about 2.2 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Moderately well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table (depth, kind): About 41 to 91 centimeters, perched (see table 25)
Available water capacity (entire profile): Very high (about 12.7 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 2e
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)
Dominant vegetation map class(es):
Eastern Hemlock Plateau Forest
Successional (Virginia, Pitch) Pine Forest
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest

Hydric soil status: No
Hydrologic soil group: C

Representative Profile
Oe—0 to 3 centimeters; moderately decomposed plant material
A—3 to 8 centimeters; silt loam
AB—8 to 23 centimeters; silt loam
Bt—23 to 66 centimeters; loam
BC—66 to 86 centimeters; loam
C—86 to 99 centimeters; loam
R—99 to 109 centimeters; bedrock

Minor Components

Clifftop soils
Percent of map unit: 5 percent
Slope: 3 to 8 percent
Landform: Ridges
Hydric soil status: No

Dekalb soils
Percent of map unit: 5 percent
Slope: 3 to 15 percent
Landform: Ridges
Hydric soil status: No

Laidig soils
Percent of map unit: 5 percent
Slope: 3 to 15 percent
Landform: Drainageways and footslopes on mountain slopes
Hydric soil status: No

FeC—Fenwick silt loam, 8 to 15 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 403 to 586 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Fenwick and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of the Fenwick Soil

Classification
Fine-loamy, mixed, semiactive, mesic Aquic Hapludults

Setting
Landform: Broad ridges
Landform position (three-dimensional): Mountaintop
Down-slope shape: Convex
Across-slope shape: Convex

Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 8 to 15 percent
Parent material: Residuum weathered from sandstone and shale

Properties and Qualities
Depth to restrictive feature: 51 to 109 centimeters to lithic bedrock
Shrink-swell potential: Low (about 2.2 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Moderately well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table (depth, kind): About 41 to 91 centimeters, perched (see table 25)
Available water capacity (entire profile): Very high (about 12.7 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)
Dominant vegetation map class(es):
Successional (Virginia, Pitch) Pine Forest
Successional Tuliptree Forest
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Hydric soil status: No
Hydrologic soil group: C

Representative Profile
Oe—0 to 3 centimeters; moderately decomposed plant material
A—3 to 8 centimeters; silt loam
AB—8 to 23 centimeters; silt loam
Bt—23 to 66 centimeters; loam
BC—66 to 86 centimeters; loam
C—86 to 99 centimeters; loam
R—99 to 109 centimeters; bedrock

Minor Components

Clifftop soils
Percent of map unit: 5 percent
Slope: 8 to 15 percent
Landform: Ridges
Hydric soil status: No

Dekalb soils
Percent of map unit: 5 percent
Slope: 8 to 20 percent
Landform: Ridges
Hydric soil status: No

Laidig soils
Percent of map unit: 5 percent
Slope: 8 to 20 percent
Landform: Drainageways and footslopes on mountain slopes
Hydric soil status: No

HgE—Highsplint channery loam, 15 to 35 percent slopes, very stony

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 320 to 352 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Highsplint and similar soils: 70 percent
Dissimilar minor components: 30 percent

Description of the Highsplint Soil

Classification
Loamy-skeletal, mixed, active, mesic Typic Dystrudepts

Setting
Landform: Mountain slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Mountain flank
Down-slope shape: Linear
Across-slope shape: Concave
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 15 to 35 percent
Parent material: Very stony colluvium derived from interbedded sedimentary rock, mainly members of the Kanawha Formation of the Pottsville Group

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Shrink-swell potential: Low (about 2.1 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 15.8 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 6s
West Virginia grassland suitability group (WVGSG): Very Rocky, Acid Soils (RA3)
Dominant vegetation map class(es):
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Sugar Maple - Yellow Buckeye - American Basswood Forest
Oak - Hickory - Sugar Maple Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 2 centimeters; slightly decomposed plant material
Oe—2 to 4 centimeters; moderately decomposed plant material
A—4 to 22 centimeters; channery loam and very channery loam
BA—22 to 31 centimeters; very channery loam
Bw—31 to 120 centimeters; very channery loam
BC—120 to 140 centimeters; extremely channery loam
C—140 to 165 centimeters; extremely channery loam

Minor Components

Laidig soils
Percent of map unit: 10 percent
Slope: 15 to 35 percent
Landform: Mountain slopes
Hydric soil status: No

Pineville soils
Percent of map unit: 10 percent
Slope: 15 to 35 percent
Landform: Mountain slopes
Hydric soil status: No

Berks soils
Percent of map unit: 5 percent
Slope: 15 to 35 percent
Landform: Convex mountain slopes
Dominant vegetation map class(es):
Oak - Hickory Forest
Hydric soil status: No

Clifftop soils
Percent of map unit: 3 percent
Slope: 25 to 35 percent
Landform: Mountain slopes
Dominant vegetation map class(es):
Oak - Hickory Forest
Hydric soil status: No

Cotaco soils
Percent of map unit: 2 percent
Slope: 8 to 15 percent
Landform: Remnant stream terraces in mountain valleys
Hydric soil status: No

LaC—Laidig channery loam, 3 to 15 percent slopes, rubbly

Map Unit Setting

Landscape: Mountains (fig. 8)
Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 327 to 578 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Figure 8.—A representative area of Laidig channery loam, 3 to 15 percent slopes, rubbly. Eastern hemlock and rhododendron are common in areas of Laidig soils.

Map Unit Composition

Laidig and similar soils: 70 percent
Dissimilar minor components: 30 percent

Description of the Laidig Soil

Classification
Fine-loamy, siliceous, semiactive, mesic Typic Fragiudults

Setting
Landform: Mountain slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Mountain base
Down-slope shape: Linear and concave
Across-slope shape: Concave and linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 3 to 15 percent
Parent material: Rubbly colluvium derived from interbedded sedimentary rock

Properties and Qualities
Depth to restrictive feature: 76 to 127 centimeters to a fragipan
Shrink-swell potential: Low (about 1.2 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately low
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table (depth, kind): About 76 to 117 centimeters, perched (see table 25)
Available water capacity (entire profile): Very high (about 23.4 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Very Rocky, Acid Soils (RA3)
Dominant vegetation map class(es):
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Sugar Maple - Yellow Buckeye - American Basswood Forest
Eastern Hemlock Plateau Forest
Hydric soil status: No
Hydrologic soil group: C

Representative Profile
Oi—0 to 2 centimeters; stony slightly decomposed plant material
A—2 to 9 centimeters; gravelly highly organic loam
A/B—9 to 19 centimeters; gravelly loam
Bt1—19 to 80 centimeters; gravelly loam
Bt2—80 to 122 centimeters; gravelly loam
Btx—122 to 200 centimeters; gravelly loam

Minor Components

Layland soils
Percent of map unit: 13 percent
Slope: 15 to 35 percent
Landform: Areas below rock outcrop on mountain slopes
Hydric soil status: No

Atkins soils
Percent of map unit: 5 percent
Slope: 0 to 3 percent
Landform: Flood plains in mountain valleys
Dominant vegetation map class(es):
Forest Seep
Hydric soil status: Yes

Philo soils
Percent of map unit: 5 percent
Slope: 0 to 3 percent
Landform: Flood plains in mountain valleys
Hydric soil status: No

Pope soils
Percent of map unit: 5 percent
Slope: 0 to 3 percent
Landform: Flood plains in mountain valleys
Hydric soil status: No

Rock outcrop
Description: Sandstone outcrops on mountain slopes
Percent of map unit: 2 percent

Dominant vegetation map class(es):
Cliff Face
Hydric soil status: No

LbC—Laidig channery loam, 3 to 15 percent slopes, very rubbly

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 252 to 468 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Laidig and similar soils: 75 percent
Dissimilar minor components: 25 percent

Description of the Laidig Soil

Classification
Fine-loamy, siliceous, semiactive, mesic Typic Fragiudults

Setting
Landform: Mountain slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Mountain base
Down-slope shape: Linear and concave
Across-slope shape: Concave and linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 3 to 15 percent
Parent material: Very rubbly colluvium derived from interbedded sedimentary rock

Properties and Qualities
Depth to restrictive feature: 76 to 127 centimeters to a fragipan
Shrink-swell potential: Low (about 1.2 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately low
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table (depth, kind): About 76 to 117 centimeters, perched (see table 25)
Available water capacity (entire profile): Very high (about 23.4 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)

Dominant vegetation map class(es):
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Oak - Hickory - Sugar Maple Forest
Oak - Hickory Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 2 centimeters; extremely bouldery slightly decomposed plant material
A—2 to 9 centimeters; gravelly highly organic loam
A/B—9 to 19 centimeters; gravelly loam
Bt1—19 to 80 centimeters; gravelly loam
Bt2—80 to 122 centimeters; gravelly loam
Btx—122 to 200 centimeters; gravelly loam

Minor Components

Layland soils
Percent of map unit: 13 percent
Slope: 3 to 15 percent
Landform: Areas below rock outcrop on mountain slopes
Hydric soil status: No

Philo soils
Percent of map unit: 5 percent
Slope: 1 to 3 percent
Landform: Nearly level flood plains
Hydric soil status: No

Pope soils
Percent of map unit: 5 percent
Slope: 1 to 3 percent
Landform: Flood plains
Hydric soil status: No

Rock outcrop
Percent of map unit: 2 percent
Landform: Sandstone cliffs
Dominant vegetation map class(es):
Cliff Face
Hydric soil status: No

LcE—Laidig-Clifftop complex, 15 to 35 percent slopes, very stony

Map Unit Setting

Landscape: Mountains (fig. 9)
Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 212 to 613 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Laidig and similar soils: 45 percent

Figure 9.—Rhododendron is a common component of the understory in areas of map unit LcE, Laidig-Clifftop complex, 15 to 35 percent slopes, very stony.

Clifftop and similar soils: 25 percent
Dissimilar minor components: 30 percent

Description of the Laidig Soil

Classification
Fine-loamy, siliceous, semiactive, mesic Typic Fragiudults

Setting
Landform: Drainageways and footslopes on mountain slopes (fig. 10)
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Mountain flank
Down-slope shape: Linear and concave
Across-slope shape: Concave and linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 15 to 35 percent
Parent material: Very stony colluvium derived from interbedded sedimentary rock

Properties and Qualities
Depth to restrictive feature: 76 to 127 centimeters to a fragipan
Shrink-swell potential: Low (about 1.2 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately low
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None

Figure 10.—A landslide in an area of Laidig soils. Laidig soils on slopes of more than 25 percent have a high potential for landslides.

Seasonal water table (depth, kind): About 76 to 117 centimeters, perched (see table 25)
Available water capacity (entire profile): Very high (about 23.4 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 6s
West Virginia grassland suitability group (WVGSG): Very Rocky, Acid Soils (RA3)
Dominant vegetation map class(es):
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Hydric soil status: No
Hydrologic soil group: C

Representative Profile
Oi—0 to 2 centimeters; slightly decomposed plant material
A—2 to 9 centimeters; gravelly highly organic loam
A/B—9 to 19 centimeters; gravelly loam
Bt1—19 to 80 centimeters; gravelly loam

Bt2—80 to 122 centimeters; gravelly loam
Btx—122 to 200 centimeters; gravelly loam

Description of the Clifftop Soil

Classification
Fine-loamy, mixed, semiactive, mesic Typic Hapludults

Setting
Landform: Convex mountain slopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Upper third of mountain flank
Down-slope shape: Convex and linear
Across-slope shape: Linear and convex
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 15 to 35 percent
Parent material: Acid fine-loamy residuum weathered from shale and siltstone

Properties and Qualities
Depth to restrictive feature: 51 to 102 centimeters to paralithic bedrock
Shrink-swell potential: Low (about 2.2 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 13.0 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 6s
West Virginia grassland suitability group (WVGSG): Very Rocky, Acid Soils (RA3)
Dominant vegetation map class(es):
  Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
  Eastern Hemlock Plateau Forest
Hydric soil status: No
Hydrologic soil group: C

Representative Profile
Oi—0 to 3 centimeters; slightly decomposed plant material
A—3 to 8 centimeters; channery silt loam
BA—8 to 20 centimeters; silt loam
Bt—20 to 74 centimeters; channery silty clay loam
BC—74 to 91 centimeters; very channery silty clay loam
Cr—91 to 101 centimeters; bedrock

Minor Components

Layland soils
Percent of map unit: 15 percent
Slope: 15 to 35 percent
Landform: Mountain slopes
Hydric soil status: No

Nallen soils
Percent of map unit: 10 percent
Slope: 25 to 35 percent
Landform: Mountain slopes
Hydric soil status: No

Buchanan soils
Percent of map unit: 5 percent
Slope: 8 to 15 percent
Landform: Drainageways and footslopes on mountain slopes
Hydric soil status: No

LdF—Layland-Clifftop complex, 35 to 70 percent slopes, very stony

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 257 to 586 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Layland and simlar soils: 60 percent
Clifftop and similar soils: 20 percent
Dissimilar minor components: 20 percent

Description of the Layland Soil

Classification
Loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts

Setting
Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Upper third of mountain flank
Down-slope shape: Concave and linear
Across-slope shape: Linear, concave, and convex
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 35 to 70 percent
Parent material: Very stony colluvium derived from sandstone and siltstone

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Shrink-swell potential: Low (about 2.3 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None

Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 21.0 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Very Rocky, Acid Soils (RA3)
Dominant vegetation map class(es):
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Oak / Great Laurel Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 3 centimeters; slightly decomposed plant material
Oe—3 to 5 centimeters; moderately decomposed plant material
A—5 to 15 centimeters; gravelly loam
BA—15 to 23 centimeters; gravelly loam
Bw—23 to 117 centimeters; very gravelly loam
BC—117 to 145 centimeters; very gravelly loam
C—145 to 200 centimeters; very gravelly loam

Description of the Clifftop Soil

Classification
Fine-loamy, mixed, semiactive, mesic Typic Hapludults

Setting
Landform: Convex mountain slopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Upper third of mountain flank and side slope
Down-slope shape: Convex
Across-slope shape: Convex
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 35 to 70 percent
Parent material: Acid fine-loamy residuum weathered from shale and siltstone

Properties and Qualities
Depth to restrictive feature: 51 to 102 centimeters to paralithic bedrock
Shrink-swell potential: Low (about 2.2 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 13.0 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Very Rocky, Acid Soils (RA3)
Dominant vegetation map class(es):
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Oak / Great Laurel Forest

Hydric soil status: No
Hydrologic soil group: C

Representative Profile
Oi—0 to 3 centimeters; slightly decomposed plant material
A—3 to 8 centimeters; channery silt loam
BA—8 to 20 centimeters; silt loam
Bt—20 to 74 centimeters; channery silty clay loam
BC—74 to 91 centimeters; very channery silty clay loam
Cr—91 to 101 centimeters; bedrock

Minor Components

Nallen soils
Percent of map unit: 10 percent
Slope: 25 to 70 percent
Landform: Mountain slopes
Hydric soil status: No

Dekalb soils
Percent of map unit: 5 percent
Slope: 35 to 70 percent
Landform: Mountain slopes
Hydric soil status: No

Laidig soils
Percent of map unit: 5 percent
Slope: 15 to 35 percent
Landform: Drainageways and footslopes on mountain slopes
Hydric soil status: No

LhE—Layland-Laidig complex, 15 to 35 percent slopes, rubbly

Map Unit Setting

Landscape: Mountains (fig. 11)
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains and 125—Cumberland Plateau and Mountains
Elevation: 229 to 589 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Layland and similar soils: 60 percent
Laidig and similar soils: 25 percent
Dissimilar minor components: 15 percent

Description of the Layland Soil

Classification
Loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts

Setting
Landform: Mountain slopes
Landform position (two-dimensional): Backslope and footslope
Landform position (three-dimensional): Mountain base and mountain flank

Figure 11.—A young stand of eastern hemlock in an area of Layland-Laidig complex, 15 to 35 percent slopes, rubbly.

Down-slope shape: Concave and linear
Across-slope shape: Linear, concave, and convex
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 15 to 35 percent
Parent material: Rubbly, acid colluvium derived from interbedded sedimentary rock

Properties and Qualities

Depth to restrictive feature: None within a depth of 150 centimeters
Shrink-swell potential: Low (about 2.3 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties

Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 21.0 centimeters)

Interpretive Groups

Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Very Rocky, Acid Soils (RA3)

Dominant vegetation map class(es):
  Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
  Eastern Hemlock Plateau Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 3 centimeters; stony slightly decomposed plant material
Oe—3 to 5 centimeters; stony moderately decomposed plant material
A—5 to 15 centimeters; gravelly loam
BA—15 to 23 centimeters; gravelly loam
Bw—23 to 117 centimeters; very gravelly loam
BC—117 to 145 centimeters; very gravelly loam
C—145 to 200 centimeters; very gravelly loam

Description of the Laidig Soil

Classification
Fine-loamy, siliceous, semiactive, mesic Typic Fragiudults

Setting
Landform: Mountain slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Mountain base
Down-slope shape: Linear and concave
Across-slope shape: Concave and linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 15 to 35 percent
Parent material: Rubbly colluvium derived from interbedded sedimentary rock

Properties and Qualities
Depth to restrictive feature: 76 to 127 centimeters to a fragipan
Shrink-swell potential: Low (about 1.2 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately low
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table (depth, kind): About 76 to 117 centimeters, perched (see table 25)
Available water capacity (entire profile): Very high (about 23.4 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Very Rocky, Acid Soils (RA3)
Dominant vegetation map class(es):
  Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
  Eastern Hemlock Plateau Forest
Hydric soil status: No
Hydrologic soil group: C

Representative Profile
Oi—0 to 2 centimeters; stony slightly decomposed plant material

A—2 to 9 centimeters; gravelly highly organic loam
A/B—9 to 19 centimeters; gravelly loam
Bt1—19 to 80 centimeters; gravelly loam
Bt2—80 to 122 centimeters; gravelly loam
Btx—122 to 200 centimeters; gravelly loam

Minor Components

Dekalb soils
Percent of map unit: 10 percent
Slope: 35 to 70 percent
Landform: Mountain slopes
Hydric soil status: No

Philo soils
Percent of map unit: 3 percent
Slope: 0 to 3 percent
Landform: Flood plains in mountain valleys
Hydric soil status: No

Rock outcrop
Description: Sandstone outcrops on mountain slopes
Percent of map unit: 2 percent
Dominant vegetation map class(es):
Cliff Face
Hydric soil status: No

LkE—Layland-Laidig complex, 15 to 35 percent slopes, very rubbly

Map Unit Setting

Landscape: Mountains (fig. 12)
Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 214 to 556 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Layland and similar soils: 55 percent
Laidig and similar soils: 30 percent
Dissimilar minor components: 15 percent

Description of the Layland Soil

Classification
Loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts

Setting
Landform: Areas below rock outcrop on mountain slopes
Landform position (two-dimensional): Backslope and footslope
Landform position (three-dimensional): Mountain base and lower third of mountain flank
Down-slope shape: Concave and linear
Across-slope shape: Linear, concave, and convex

Figure 12.—Typical landscape of Layland-Laidig complex, 15 to 35 percent slopes, very rubbly. Stones and boulders cover 50 to 90 percent of the surface.

Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 15 to 35 percent
Parent material: Very rubbly colluvium derived from sandstone and siltstone

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Shrink-swell potential: Low (about 2.3 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 21.0 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Hydric soil status: No
Hydrologic soil group: A

Representative Profile
Oi—0 to 3 centimeters; extremely bouldery slightly decomposed plant material
Oe—3 to 5 centimeters; extremely bouldery moderately decomposed plant material
A—5 to 15 centimeters; gravelly loam
BA—15 to 23 centimeters; gravelly loam
Bw—23 to 117 centimeters; very gravelly loam
BC—117 to 145 centimeters; very gravelly loam
C—145 to 200 centimeters; very gravelly loam

Description of the Laidig Soil

Classification
Fine-loamy, siliceous, semiactive, mesic Typic Fragiudults

Setting
Landform: Drainageways and footslopes on mountain slopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Lower third of mountain flank and mountain base
Down-slope shape: Linear and concave
Across-slope shape: Concave and linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 15 to 35 percent
Parent material: Very rubbly colluvium derived from interbedded sedimentary rock

Properties and Qualities
Depth to restrictive feature: 76 to 127 centimeters to a fragipan
Shrink-swell potential: Low (about 1.2 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately low
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table (depth, kind): About 76 to 117 centimeters, perched (see table 25)
Available water capacity (entire profile): Very high (about 23.4 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 2 centimeters; extremely bouldery slightly decomposed plant material
A—2 to 9 centimeters; gravelly highly organic loam
A/B—9 to 19 centimeters; gravelly loam
Bt1—19 to 80 centimeters; gravelly loam
Bt2—80 to 122 centimeters; gravelly loam
Btx—122 to 200 centimeters; gravelly loam

Minor Components

Buchanan soils
Percent of map unit: 9 percent
Slope: 8 to 15 percent
Landform: Drainageways and footslopes on mountain slopes
Hydric soil status: No

Craigsville soils
Percent of map unit: 2 percent
Slope: 0 to 3 percent
Landform: Flood plains in river valleys
Dominant vegetation map class(es):
Eastern Hemlock Floodplain Forest
(Virginia, Pitch) Pine Floodplain Forest
Hydric soil status: No

Pope soils
Percent of map unit: 2 percent
Slope: 0 to 3 percent
Landform: Flood plains
Dominant vegetation map class(es):
Eastern Hemlock Floodplain Forest
Hydric soil status: No

Riverwash
Description: Water-deposited sand, gravel, and cobbles along the rivers
Percent of map unit: 1 percent
Slope: 0 to 3 percent
Dominant vegetation map class(es):
American Sycamore - River Birch Riverscour Woodland
Hydric soil status: No

Rock outcrop
Description: Sandstone outcrops on mountain slopes
Percent of map unit: 1 percent
Dominant vegetation map class(es):
Cliff Face
Hydric soil status: No

LmF—Layland-Rock outcrop complex, 35 to 70 percent slopes, very rubbly

Map Unit Setting

Landscape: Mountains (fig. 13)
Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 212 to 600 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Layland and similar soils: 60 percent

Figure 13.—Typical landscape of Layland-Rock outcrop complex, 35 to 70 percent slopes, very rubbly. The Lower Nuttall sandstone forms the prominent cliffs (Rock outcrop) on both sides of the Gauley River.

Rock outcrop: 10 percent
Dissimilar minor components: 30 percent

Description of the Layland Soil

Classification
Loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts

Setting
Landform: Areas below rock outcrop on mountain slopes (fig. 14)
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountain flank
Down-slope shape: Concave and linear
Across-slope shape: Linear, concave, and convex
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 35 to 70 percent
Parent material: Very rubbly colluvium derived from sandstone and siltstone

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Shrink-swell potential: Low (about 2.3 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Figure 14.—The Layland soil in Layland-Rock outcrop complex, 35 to 70 percent slopes, very rubbly, is covered with rubble consisting of stones and boulders. Some of the boulders are huge, 12 meters (40 feet) or more in diameter.

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 21.0 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Sugar Maple - Yellow Buckeye - American Basswood Forest
Oak / Great Laurel Forest
Hydric soil status: No
Hydrologic soil group: A

Representative Profile
Oi—0 to 3 centimeters; extremely bouldery slightly decomposed plant material
Oe—3 to 5 centimeters; extremely bouldery moderately decomposed plant material
A—5 to 15 centimeters; gravelly loam
BA—15 to 23 centimeters; gravelly loam
Bw—23 to 117 centimeters; very gravelly loam
BC—117 to 145 centimeters; very gravelly loam
C—145 to 200 centimeters; very gravelly loam

Description of Rock Outcrop

Setting
Landform: Sandstone escarpments
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountain flank
Aspect (representative): South
Aspect range: All aspects
Parent material: The Lower Nuttall sandstone of the New River Formation of the Pottsville Group

Interpretive Groups
Land capability subclass (nonirrigated): 8s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Cliff Face
Hydric soil status: No

Minor Components

Laidig soils
Percent of map unit: 10 percent
Slope: 15 to 35 percent
Landform: Drainageways and footslopes on mountain slopes
Hydric soil status: No

Clifftop soils
Percent of map unit: 5 percent
Slope: 35 to 70 percent
Landform: Convex mountain slopes
Hydric soil status: No

Dekalb soils
Percent of map unit: 5 percent
Slope: 55 to 80 percent
Landform: Mountain slopes
Hydric soil status: No

Guyandotte soils
Percent of map unit: 5 percent
Slope: 35 to 55 percent
Landform: North-facing mountain slopes
Hydric soil status: No

Rubble land
Description: Boulder and stone topple deposits along rivers
Percent of map unit: 4 percent
Slope: 35 to 70 percent
Hydric soil status: No

Totz soils (fig. 15)
Percent of map unit: 1 percent
Slope: 3 to 25 percent
Landform: Areas near rock outcrop on mountain slopes
Dominant vegetation map class(es):
Cliff Top Virginia Pine Forest
Hydric soil status: No

Figure 15.—An area of the shallow, excessively drained Totz soils that formed on top of the Lower Nuttall sandstone cliffs. Totz soils are a minor component of map unit LmF. Virginia pine is a common tree on these very droughty soils.

LuC—Lithic Udorthents, leveled land, 0 to 15 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 301 to 377 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Lithic Udorthents and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of the Lithic Udorthents

Classification
Lithic Udorthents

General
Lithic Udorthents, leveled land consists of soils that have been drastically disturbed by humans with the use of heavy machinery. These soils are in areas where the native soils have been excavated and the underlying bedrock exposed or nearly exposed. In the park, they are in the area that was excavated for construction of the spillway for the Summersville Dam. The soils formed in materials weathered from the exposed bedrock and/or bedrock materials that have been crushed and worked by heavy machinery or formed in the remnant substratum of the original native soil. They are typically less than 50 centimeters deep; are loamy in the fine-earth fraction; contain

more than 35 percent rock fragments, by volume, in the soil profile; and have a low water-holding capacity. Soil properties such as texture, bulk density, soil reaction (pH), and saturated hydraulic conductivity are highly variable. Because the soil properties are highly variable, an onsite investigation is required to determine the suitability of these soils for use and management.

Setting
Landform: Drastically disturbed areas on mountain slopes
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 0 to 15 percent
Parent material: Cut and fill materials derived from native soils and interbedded sedimentary rock

Properties and Qualities
Depth to restrictive feature: 10 to 50 centimeters to lithic bedrock
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Natural drainage class: Somewhat excessively drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very low (about 1.5 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 8s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Successional (Virginia, Pitch) Pine Forest
Disturbed Area
Hydric soil status: No
Hydrologic soil group: D

Representative Profile
A—0 to 10 centimeters; very gravelly loam
C—10 to 22 centimeters; extremely gravelly sandy loam
R—22 to 32 centimeters; bedrock

Minor Components

Udorthents
Percent of map unit: 10 percent
Slope: 0 to 15 percent
Hydric soil status: No

Rock outcrop
Description: Bedrock exposed during construction practices
Percent of map unit: 5 percent
Hydric soil status: No

LxG—Lithic Udorthents-Rock outcrop complex, cut land, 5 to 100 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 125—Cumberland Plateau and Mountains
Elevation: 301 to 377 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Lithic Udorthents and similar soils: 50 percent
Rock outcrop: 40 percent
Dissimilar minor components: 10 percent

Description of the Lithic Udorthents

Classification
Lithic Udorthents

General

Lithic Udorthents, cut land consists of soils that have been drastically disturbed by humans with the use of heavy machinery. These soils are in areas where the native soils and the underlying bedrock have been excavated (cut). In the park, they are in areas that have been excavated for the construction of highways and railroads. They formed in materials weathered from the exposed bedrock and/or bedrock materials that have been crushed and worked by heavy machinery or formed in the remnant substratum of the original native soil. These soils are typically less than 50 centimeters deep; are loamy in the fine-earth fraction; contain more than 35 percent rock fragments, by volume, in the soil profile; and have a low water-holding capacity. Soil properties such as texture, bulk density, soil reaction (pH), and saturated hydraulic conductivity are highly variable. Because the soil properties are highly variable, an onsite investigation is required to determine the suitability of these soils for use and management.

Setting
Landform: Drastically disturbed areas on mountain slopes
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 5 to 100 percent
Parent material: Cut and fill materials derived from native soils and interbedded sedimentary rock

Properties and Qualities
Depth to restrictive feature: 10 to 50 centimeters to lithic bedrock
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Natural drainage class: Somewhat excessively drained
Flooding frequency: None
Ponding frequency: None

Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very low (about 1.5 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 8s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Successional (Virginia, Pitch) Pine Forest
Disturbed Area
Hydric soil status: No
Hydrologic soil group: D

Representative Profile
A—0 to 10 centimeters; very gravelly loam
C—10 to 22 centimeters; extremely gravelly sandy loam
R—22 to 32 centimeters; bedrock

Description of Rock Outcrop

General
Rock outcrop consists of native bedrock exposed along excavations made to create road beds and related projects

Interpretive Groups
Land capability subclass (nonirrigated): 8s

Minor Components

Udorthents
Description: Earthy materials, graded and nongraded, that have been exposed during construction practices
Percent of map unit: 10 percent
Slope: 5 to 100 percent

NaB—Nallen loam, 3 to 8 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 523 to 528 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Nallen and similar soils: 80 percent
Dissimilar minor components: 20 percent

Description of the Nallen Soil

Classification
Coarse-loamy, siliceous, semiactive, mesic Typic Hapludults

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountaintop
Down-slope shape: Linear

Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 3 to 8 percent
Parent material: Acid coarse-loamy residuum weathered from sandstone

Properties and Qualities
Depth to restrictive feature: 51 to 102 centimeters to lithic bedrock
Shrink-swell potential: Low (about 2.1 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): High (about 10.2 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 2e
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)
Dominant vegetation map class(es):
Eastern Hemlock Plateau Forest
Oak - Hickory Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 3 centimeters; slightly decomposed plant material
Oe—3 to 4 centimeters; moderately decomposed plant material
A—4 to 13 centimeters; loam
BA—13 to 23 centimeters; loam
Bt—23 to 48 centimeters; loam
BC+C—48 to 86 centimeters; channery sandy loam
R—86 to 96 centimeters; bedrock

Minor Components

Dekalb soils
Percent of map unit: 10 percent
Slope: 3 to 9 percent
Landform: Ridges
Hydric soil status: No

Clifftop soils
Percent of map unit: 5 percent
Slope: 3 to 8 percent
Landform: Ridges
Hydric soil status: No

Fenwick soils
Percent of map unit: 5 percent
Slope: 3 to 8 percent
Landform: Broad ridges
Hydric soil status: No

Figure 16.—A typical area of Nallen loam, 8 to 15 percent slopes, on a summit underlain by the Upper Nuttall sandstone. Ericaceous plants, such as mountain laurel, are a common understory plant on the acid Nallen soils.

NaC—Nallen loam, 8 to 15 percent slopes

Map Unit Setting

Landscape: Mountains (fig. 16)
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 325 to 584 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Nallen and similar soils: 75 percent
Dissimilar minor components: 25 percent

Description of the Nallen Soil

Classification
Coarse-loamy, siliceous, semiactive, mesic Typic Hapludults

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountaintop
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 8 to 15 percent
Parent material: Acid coarse-loamy residuum weathered from sandstone

Properties and Qualities
Depth to restrictive feature: 51 to 102 centimeters to lithic bedrock
Shrink-swell potential: Low (about 2.1 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): High (about 10.2 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 3e
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)
Dominant vegetation map class(es):
Eastern Hemlock Plateau Forest
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Oak - Hickory Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 3 centimeters; slightly decomposed plant material
Oe—3 to 4 centimeters; moderately decomposed plant material
A—4 to 13 centimeters; loam
BA—13 to 23 centimeters; loam
Bt—23 to 48 centimeters; loam
BC+C—48 to 86 centimeters; channery sandy loam
R—86 to 96 centimeters; bedrock

Minor Components

Dekalb soils
Percent of map unit: 10 percent
Slope: 8 to 15 percent
Landform: Ridges
Hydric soil status: No

Clifftop soils
Percent of map unit: 5 percent
Slope: 8 to 15 percent
Landform: Ridges
Hydric soil status: No

Cookport soils
Percent of map unit: 5 percent
Slope: 3 to 8 percent
Landform: Broad ridges
Hydric soil status: No

Fenwick soils
Percent of map unit: 5 percent

Slope: 3 to 8 percent
Landform: Broad ridges
Hydric soil status: No

NaD—Nallen loam, 15 to 25 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 297 to 569 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Nallen and similar soils: 75 percent
Dissimilar minor components: 25 percent

Description of the Nallen Soil

Classification
Coarse-loamy, siliceous, semiactive, mesic Typic Hapludults

Setting
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Mountaintop
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 15 to 25 percent
Parent material: Acid coarse-loamy residuum weathered from sandstone

Properties and Qualities
Depth to restrictive feature: 51 to 102 centimeters to lithic bedrock
Shrink-swell potential: Low (about 2.1 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): High (about 10.2 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 4e
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)
Dominant vegetation map class(es):
Oak - Hickory Forest

Eastern Hemlock Plateau Forest
Oak / Great Laurel Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 3 centimeters; slightly decomposed plant material
Oe—3 to 4 centimeters; moderately decomposed plant material
A—4 to 13 centimeters; loam
BA—13 to 23 centimeters; loam
Bt—23 to 48 centimeters; loam
BC+C—48 to 86 centimeters; channery sandy loam
R—86 to 96 centimeters; bedrock

Minor Components

Clymer soils
Percent of map unit: 10 percent
Slope: 15 to 25 percent
Landform: Ridges
Hydric soil status: No

Clifftop soils
Percent of map unit: 5 percent
Slope: 15 to 35 percent
Landform: Ridges
Hydric soil status: No

Dekalb soils
Percent of map unit: 5 percent
Slope: 15 to 35 percent
Landform: Ridges
Hydric soil status: No

Fenwick soils
Percent of map unit: 5 percent
Slope: 8 to 15 percent
Landform: Broad ridges
Hydric soil status: No

PsA—Pope sandy loam, 0 to 3 percent slopes, rarely flooded

Map Unit Setting

Landscape: Mountains (fig. 17)
Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 213 to 374 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Pope and similar soils: 85 percent
Dissimilar minor components: 15 percent

Figure 17.—Old foundation stones in an area of Pope sandy loam, 0 to 3 percent slopes, rarely flooded, near the old Carnifex Ferry site at the confluence of the Gauley and Meadow Rivers.

Description of the Pope Soil

Classification
Coarse-loamy, mixed, active, mesic Fluventic Dystrudepts

Setting
Landform: Flood plains in river valleys
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 0 to 3 percent
Parent material: Coarse-loamy alluvium derived from sandstone and shale

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: Rare (see table 25)
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 27.3 centimeters)

Figure 18.—A ponded area of Atkins soil in an area of Pope sandy loam, 0 to 3 percent slopes, rarely flooded, near the old Carnifex Ferry site at the confluence of the Gauley and Meadow Rivers. Atkins soils are a minor component of the map unit. They have a hydric soil status.

Interpretive Groups

Land capability subclass (nonirrigated): 1
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)
Dominant vegetation map class(es):
Successional Tuliptree Forest
Eastern Hemlock Floodplain Forest
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Oak - Hickory Floodplain Forest
Disturbed Area
(Virginia, Pitch) Pine Floodplain Forest
Hydric soil status: No
Hydrologic soil group: A

Representative Profile

Oi—0 to 3 centimeters; slightly decomposed plant material
Oe—3 to 5 centimeters; moderately decomposed plant material
A—5 to 18 centimeters; sandy loam
Bw—18 to 81 centimeters; sandy loam
C—81 to 200 centimeters; very gravelly sandy loam

Minor Components

Atkins soils (fig. 18)
Percent of map unit: 5 percent

Slope: 0 to 3 percent
Landform: Nearly level flood plains
Hydric soil status: Yes

Philo soils
Percent of map unit: 5 percent
Slope: 0 to 3 percent
Landform: Nearly level flood plains
Hydric soil status: No

Riverwash
Description: Water-deposited sand, gravel, and cobbles along rivers
Percent of map unit: 5 percent
Slope: 0 to 3 percent
Dominant vegetation map class(es):
American Sycamore - River Birch Riverscour Woodland
Hydric soil status: No

PvA—Pope-Craigsville complex, 0 to 3 percent slopes, occasionally flooded

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 211 to 515 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Pope and similar soils: 50 percent
Craigsville and similar soils: 30 percent
Dissimilar minor components: 20 percent

Description of the Pope Soil

Classification
Coarse-loamy, mixed, active, mesic Fluventic Dystrudepts

Setting
Landform: Flood plains in river valleys
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 0 to 3 percent
Parent material: Coarse-loamy alluvium derived from sandstone and shale

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum based on representative value: Nonsaline

Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Well drained
Flooding frequency: Occasional (see table 25)
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 27.3 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 2w
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)
Dominant vegetation map class(es):
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Eastern Hemlock Floodplain Forest
Riparian Zone
American Sycamore - Tuliptree - Sweetgum Floodplain Forest
(Virginia, Pitch) Pine Floodplain Forest
Hydric soil status: No
Hydrologic soil group: A

Representative Profile
Oi—0 to 3 centimeters; slightly decomposed plant material
Oe—3 to 5 centimeters; moderately decomposed plant material
A—5 to 18 centimeters; sandy loam
Bw—18 to 81 centimeters; sandy loam
C—81 to 200 centimeters; very gravelly sandy loam

Description of the Craigsville Soil

Classification
Loamy-skeletal, mixed, superactive, mesic Fluventic Dystrudepts

Setting
Landform: Flood plains in river valleys
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 0 to 3 percent
Parent material: Skeletal loamy alluvium derived from sandstone and shale

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): High
Natural drainage class: Well drained
Flooding frequency: Occasional (see table 25)
Ponding frequency: None

Seasonal water table (depth, kind): About 102 to 152 centimeters (see table 25)
Available water capacity (entire profile): Very high (about 15.2 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 2w
West Virginia grassland suitability group (WVGSG): Acid Loams (AL3)
Dominant vegetation map class(es):
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Eastern Hemlock Floodplain Forest
Riparian Zone
American Sycamore - Tuliptree - Sweetgum Floodplain Forest
(Virginia, Pitch) Pine Floodplain Forest
Hydric soil status: No
Hydrologic soil group: A

Representative Profile
Oi—0 to 5 centimeters; slightly decomposed plant material
Oe—5 to 8 centimeters; moderately decomposed plant material
A—8 to 21 centimeters; very gravelly sandy loam
Bw—21 to 60 centimeters; very gravelly sandy loam
C—60 to 200 centimeters; extremely gravelly loamy coarse sand

Minor Components

Philo soils
Percent of map unit: 10 percent
Slope: 0 to 3 percent
Landform: Nearly level flood plains
Hydric soil status: No

Riverwash
Description: Water-deposited sand, gravel, and cobbles along rivers
Percent of map unit: 5 percent
Slope: 0 to 3 percent
Dominant vegetation map class(es):
American Sycamore - River Birch Riverscour Woodland
American Water-willow Cobble Bar
Hydric soil status: No

Atkins soils
Percent of map unit: 5 percent
Slope: 0 to 3 percent
Landform: Nearly level flood plains
Dominant vegetation map class(es):
Back Channel
Hydric soil status: Yes

Rw—Riverwash, frequently flooded

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 211 to 511 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Riverwash: 95 percent
Dissimilar minor components: 5 percent

Description of Riverwash

General

Riverwash consists of unstabilized sandy, silty, gravelly, or cobbly sediments that are frequently flooded, washed, and reworked by the river. Most areas support little or no vegetation.

Setting

Landform: Sand and cobble bars along rivers on high-energy flood plains in river valleys
Landform position (two-dimensional): Toeslope
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 0 to 3 percent
Parent material: Sandy and gravelly alluvium derived from interbedded sedimentary rock

Properties and Qualities

Depth to restrictive feature: None within a depth of 150 centimeters
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Interpretive Groups

Land capability subclass (nonirrigated): 8w
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Riparian Zone
River
Hydric soil status: No

Minor Components

Rubble land

Description: Boulder and stone topple deposits along rivers
Percent of map unit: 5 percent
Hydric soil status: No

ThB—Typic Haplorthods, 0 to 8 percent slopes, rubbly, rarely flooded

Map Unit Setting

Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 412 to 418 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Typic Haplorthods and simlar soils: 80 percent
Dissimilar minor components: 20 percent

Description of the Typic Haplorthods

Classification
Loamy-skeletal, siliceous, active, mesic Typic Haplorthods

Setting
Landform: Islands in river valleys
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear and concave
Across-slope shape: Concave
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 0 to 8 percent
Parent material: Acid, stony alluvium derived from sandstone

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Shrink-swell potential: Low (about 1.5 LEP)
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Slowest capacity to transmit water (K_{sat}): Moderately high
Natural drainage class: Somewhat excessively drained
Flooding frequency: Rare (see table 25)
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters
Available water capacity (entire profile): Very high (about 12.2 centimeters)

Interpretive Groups
Land capability subclass (nonirrigated): 7s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Eastern Hemlock Floodplain Forest
Hydric soil status: No
Hydrologic soil group: B

Representative Profile
Oi—0 to 2 centimeters; stony slightly decomposed plant material
Oe—2 to 4 centimeters; stony moderately decomposed plant material
A—4 to 13 centimeters; highly organic sandy loam
E—13 to 33 centimeters; loamy sand
Bhs—33 to 43 centimeters; sandy loam
Bs—43 to 92 centimeters; extremely stony sandy loam
C—92 to 165 centimeters; extremely stony loamy sand

Minor Components

Craigsville soils
Percent of map unit: 10 percent
Slope: 0 to 8 percent

Landform: Flood plains in river valleys
Hydric soil status: No

Pope soils
Percent of map unit: 5 percent
Slope: 0 to 3 percent
Landform: Flood plains in river valleys
Hydric soil status: No

Riverwash
Description: Water-deposited sand, gravel, and cobbles along rivers
Percent of map unit: 5 percent
Slope: 0 to 3 percent
Dominant vegetation map class(es):
Riparian zone
Hydric soil status: No

UgC—Udorthents, graded, 0 to 15 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 303 to 580 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Udorthents and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of the Udorthents

Classification
Udorthents

General
Udorthents, graded are soils that have been drastically disturbed by humans with the use of heavy machinery. In the park, these soils typically are areas that have been filled and graded for road beds, building sites, parking areas, and river access areas. The soils are typically derived from a mixture of excavated and graded native soils and crushed bedrock. Construction materials, such as chunks of concrete, are part of the soil mixture in some areas. These soils are typically more than 150 centimeters deep, are loamy in the fine-earth fraction, and contain more than 35 percent rock fragments, by volume, throughout. Rock fragments in the soil profile consist of sandstone, siltstone, shale, coal, or limestone in various proportions. Soil properties such as texture, bulk density, soil reaction (pH), saturated hydraulic conductivity, and available water capacity are highly variable. Because the soil properties are highly variable, an onsite investigation is required to determine the suitability of these soils for use and management.

Setting
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects

Slope range: 0 to 15 percent
Parent material: Cut and fill materials derived from native soils and interbedded sedimentary rock

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters

Interpretive Groups
Land capability subclass (nonirrigated): 7e
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Disturbed Area
Developed Area
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Hydric soil status: No

Representative Profile
A—0 to 4 centimeters; very channery silt loam
AC—4 to 27 centimeters; very channery silt loam
C—27 to 165 centimeters; extremely channery silt loam

Minor Components

Lithic Udorthents
Description: Drastically disturbed areas on mountain slopes
Percent of map unit: 5 percent
Slope: 0 to 15 percent
Hydric soil status: No

Rock outcrop
Description: Bedrock exposed during construction activities
Percent of map unit: 5 percent
Hydric soil status: No

Urban land
Description: Areas that have been paved with asphalt or concrete and are impervious to water
Percent of map unit: 5 percent
Slope: 0 to 15 percent
Dominant vegetation map class(es):
Road
Hydric soil status: No

UgF—Udorthents, graded, 15 to 55 percent slopes

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains

Elevation: 302 to 560 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Udorthents and similar soils: 85 percent
Dissimilar minor components: 15 percent

Description of the Udorthents

Classification
Udorthents

General
Udorthents, graded are soils that have been drastically disturbed by humans with the use of heavy machinery. In the survey area, these soils typically are in areas that have been filled and graded for road beds and building sites and that have been disturbed for bridge construction. The soils are typically derived from a mixture of excavated and graded native soils and crushed bedrock. Construction materials, such as chunks of concrete, are part of the soil mixture in some areas. These soils are typically more than 150 centimeters deep, are loamy in the fine-earth fraction, and contain more than 35 percent rock fragments, by volume, throughout. Rock fragments in the soil profile consist of sandstone, siltstone, shale, coal, or limestone in various proportions. Soil properties such as texture, bulk density, soil reaction (pH), saturated hydraulic conductivity, and available water capacity are highly variable. Because the soil properties are highly variable, an onsite investigation is required to determine the suitability of these soils for use and management.

Setting
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 15 to 55 percent
Parent material: Cut and fill materials derived from native soils and interbedded sedimentary rock

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters

Interpretive Groups
Land capability subclass (nonirrigated): 8e
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Disturbed Area
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest
Successional (Virginia, Pitch) Pine Forest

Developed Area
Road
Hydric soil status: No

Representative Profile
A—0 to 4 centimeters; very channery silt loam
AC—4 to 27 centimeters; very channery silt loam
C—27 to 165 centimeters; extremely channery silt loam

Minor Components

Lithic Udorthents
Description: Drastically disturbed areas on mountain slopes
Percent of map unit: 10 percent
Slope: 15 to 55 percent
Hydric soil status: No

Rock outcrop
Description: Bedrock exposed during construction activities
Percent of map unit: 5 percent
Hydric soil status: No

Ur—Udorthents, railroad grade

Map Unit Setting

Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 215 to 518 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Udorthents and similar soils: 93 percent
Dissimilar minor components: 7 percent

Description of the Udorthents

Classification
Udorthents

General
Udorthents, railroad grade includes the rail bed and the fill which was used to create the grade. The rail bed is nearly level and is composed of crushed stone. The outslopes of the fill are typically steep or very steep. The soils on the outslopes are typically derived from a mixture of excavated and graded native soils and crushed bedrock. These soils are typically more than 150 centimeters deep and have more than 35 percent rock fragments throughout. Rock fragments in the soil consist of sandstone, siltstone, shale, coal, or limestone in various proportions. Soil properties such as texture, bulk density, soil reaction (pH), saturated hydraulic conductivity, and available water capacity are highly variable. Because the soil properties are highly variable, an onsite investigation is required to determine the suitability of these soils for use and management. In areas where the rails are active and the rail grades are being maintained, the growth of vegetation is suppressed with herbicides. Where the rails have been abandoned, the rail grades support a variety of trees, shrubs, grasses, herbs, and forbs. They also provide a media for the growth of invasive species.

Setting
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 0 to 70 percent
Parent material: Cut and fill materials derived from native soils and interbedded sedimentary rock

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Natural drainage class: Excessively drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters

Interpretive Groups
Land capability subclass (nonirrigated): 8e
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Railroad
Hydric soil status: No

Minor Components

Rock outcrop
Description: Near vertical high walls of rock, either natural or exposed during railway construction
Percent of map unit: 5 percent
Hydric soil status: No

Urban land
Description: Areas that are covered with asphalt, concrete, and other impervious materials
Percent of map unit: 1 percent
Hydric soil status: No

Endoaquepts
Percent of map unit: 1 percent
Slope: 0 to 3 percent
Landform: Closed depressions located behind the rail beds on mountain slopes
Hydric soil status: Yes

Uu—Udorthents-Urban land complex, highways

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 533 to 571 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Udorthents and similar soils: 70 percent
Urban land: 25 percent
Dissimilar minor components: 5 percent

Description of the Udorthents

Classification
Udorthents

General
Udorthents are soils that have been drastically disturbed by humans with the use of heavy machinery. In the park, these soils typically are in areas that have been filled and graded for road beds along divided highways, such as U.S. Routes 19 and 64. The soils are typically derived from a mixture of excavated and graded native soils and crushed bedrock. These soils are typically more than 150 centimeters deep, are loamy in the fine-earth fraction, and have more than 35 percent rock fragments throughout. Rock fragments in the soil profile consist of sandstone, siltstone, shale, coal, or limestone in various proportions. Soil properties such as texture, bulk density, soil reaction (pH), saturated hydraulic conductivity, and available water capacity are highly variable. Because the soil properties are highly variable, an onsite investigation is required to determine the suitability of these soils for use and management.

Setting
Down-slope shape: Linear
Across-slope shape: Linear
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 0 to 7 percent
Parent material: Cut and fill materials derived from native soils and interbedded sedimentary rock

Properties and Qualities
Depth to restrictive feature: None within a depth of 150 centimeters
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties
Natural drainage class: Well drained
Flooding frequency: None
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters

Interpretive Groups
Land capability subclass (nonirrigated): 7e
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Disturbed Area
Hydric soil status: No

Representative Profile
A—0 to 4 centimeters; very channery silt loam
AC—4 to 27 centimeters; very channery silt loam
C—27 to 165 centimeters; extremely channery silt loam

Description of Urban Land

Setting
Description: Areas that have been paved with asphalt or concrete and are impervious to water
Aspect (representative): Southwest
Aspect range: All aspects
Slope range: 0 to 7 percent

Interpretive Groups
Land capability subclass (nonirrigated): 8s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Road
Hydric soil status: No

Minor Components

Rock outcrop
Description: Bedrock exposed during construction practices
Percent of map unit: 5 percent
Hydric soil status: No

W—Water

Map Unit Setting

Landscape: Mountains
Major land resource area(s): 125—Cumberland Plateau and Mountains and 127—Eastern Allegheny Plateau and Mountains
Elevation: 211 to 511 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Water: 90 percent
Dissimilar minor components: 10 percent

Description of Water

In the survey area, Water consists of the Gauley and Meadow Rivers, their major tributaries, and a few ponds. No interpretations are given.

Minor Components

Rubble land
Description: Rubble land consists of areas of stones and boulders that have accumulated at the base of the slope along the river; the stones and boulders have broken off the cliff, which is formed by the Lower Nuttall sandstone, and toppled into the rivers; areas of Rubble land support little or no vegetation
Percent of map unit: 9 percent
Dominant vegetation map class(es):
Riparian zone
Hydric soil status: No

Rock outcrop
Percent of map unit: 1 percent
Hydric soil status: No

Wr—Water-Rubble land complex

Major land resource area(s): 127—Eastern Allegheny Plateau and Mountains
Elevation: 339 to 488 meters
Mean annual precipitation: 1,052 to 1,346 millimeters
Mean annual air temperature: 5 to 17 degrees C
Frost-free period: 147 to 178 days

Map Unit Composition

Water: 75 percent
Rubble land: 25 percent

Description of Water

In the survey area, Water consists of the Gauley and Meadow Rivers. No interpretations are given.

Description of Rubble Land

General

Rubble land consists of areas where a mixture of sandstone stones and boulders have accumulated at the base of the slope along the river. The stones and boulders have broken off the cliff, which is formed by the Lower Nuttall sandstone, and toppled into the rivers. Areas of Rubble land support little or no vegetation.

Properties and Qualities

Depth to restrictive feature: None within a depth of 150 centimeters
Salinity maximum based on representative value: Nonsaline
Sodicity maximum: Not sodic
Calcium carbonate equivalent percent: No carbonates

Hydrologic Properties

Flooding frequency: Frequent (see table 25)
Ponding frequency: None
Seasonal water table: Not present within a depth of 160 centimeters

Interpretive Groups

Land capability subclass (nonirrigated): 8s
West Virginia grassland suitability group (WVGSG): Not Suited (NS)
Dominant vegetation map class(es):
Riparian Zone
Hydric soil status: No

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in New River Gorge National River. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils as rangeland and as sites for buildings, sanitary facilities, highways and other transportation systems, and recreational facilities. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the park. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, and trees and shrubs.

Interpretive Ratings

The interpretive tables in this survey rate the soils in the park for various uses. Many of the tables identify the limitations that affect specified uses and indicate the severity of those limitations. The ratings in these tables are both verbal and numerical.

Rating Class Terms

Rating classes are expressed in the tables in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Thus, the tables may show limitation classes or suitability classes. Terms for the limitation classes are *not limited, slightly limited, somewhat limited,* and *very limited*. The suitability ratings are expressed as *well suited, moderately well suited, poorly suited,* and *unsuited* or as *good, fair,* and *poor*.

Numerical Ratings

Numerical ratings in the tables indicate the relative severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate

gradations between the point at which a soil feature has the greatest negative impact on the use and the point at which the soil feature is not a limitation. The limitations appear in order from the most limiting to the least limiting. Thus, if more than one limitation is identified, the most severe limitation is listed first and the least severe one is listed last.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of map units in the survey area also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (USDA-SCS, 1961). Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, forestland, wildlife habitat, or recreation.

The capability classification of map units in this park is given in the section “Detailed Soil Map Units” and in table 5.

Prime and Other Important Farmland

Table 6 lists the map units in the survey area that are considered important farmlands. Important farmlands consist of prime farmland, unique farmland, and farmland of statewide or local importance. This list does not constitute a recommendation for a particular land use.

In an effort to identify the extent and location of important farmlands, the Natural Resources Conservation Service, in cooperation with other interested Federal, State, and local government organizations, has inventoried land that can be used for the production of the Nation’s food supply.

Prime farmland is of major importance in meeting the Nation’s short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation’s prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil quality, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In

general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. The water supply is dependable and of adequate quality. Prime farmland is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

For some of the soils identified in the table as prime farmland, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures.

A recent trend in land use in some areas has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables. It has the special combination of soil quality, growing season, moisture supply, temperature, humidity, air drainage, elevation, and aspect needed for the soil to economically produce sustainable high yields of these crops when properly managed. The water supply is dependable and of adequate quality. Nearness to markets is an additional consideration. Unique farmland is not based on national criteria. It commonly is in areas where there is a special microclimate, such as the wine country in California.

In some areas, land that does not meet the criteria for prime or unique farmland is considered to be *farmland of statewide importance* for the production of food, feed, fiber, forage, and oilseed crops. The criteria for defining and delineating farmland of statewide importance are determined by the appropriate State agencies. Generally, this land includes areas of soils that nearly meet the requirements for prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some areas may produce as high a yield as prime farmland if conditions are favorable. Farmland of statewide importance may include tracts of land that have been designated for agriculture by State law.

In some areas that are not identified as having national or statewide importance, land is considered to be *farmland of local importance* for the production of food, feed, fiber, forage, and oilseed crops. This farmland is identified by the appropriate local agencies. Farmland of local importance may include tracts of land that have been designated for agriculture by local ordinance.

Hydric Soils

Table 7 lists the map unit components that are rated as hydric soils in the park. This list can help in planning land uses; however, onsite investigation is recommended to determine the hydric soils on a specific site (National Research Council, 1995; Hurt and others, 2002).

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin and others, 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995; Tiner, 1985). Criteria for each of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify a phase of a soil series that normally is associated with wetlands. The criteria used are selected estimated soil properties that are described in “Soil Taxonomy” (Soil Survey Staff, 1999) and “Keys to Soil Taxonomy” (Soil Survey Staff, 2010) and in the “Soil Survey Manual” (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils in this survey area are specified in “Field Indicators of Hydric Soils in the United States” (USDA-NRCS, 2010).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described to the depth necessary for an understanding of the redoximorphic processes. Then, using the completed soil descriptions, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if at least one of the approved indicators is present.

Map units that are made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

The criteria for hydric soils are represented by codes in the table (for example, 2B3). Definitions for the codes are as follows:

1. All Histels except for Folistels and Histosols except for Folists.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
   - A. are somewhat poorly drained and have a water table at the surface (0.0 feet) during the growing season, or
   - B. are poorly drained or very poorly drained and have either:
     - 1) a water table at the surface (0.0 feet) during the growing season if textures are coarse sand, sand, or fine sand in all layers within a depth of 20 inches, or
     - 2) a water table at a depth of 0.5 foot or less during the growing season if saturated hydraulic conductivity (K_{sat}) is equal to or greater than 6.0 in/hr in all layers within a depth of 20 inches, or
     - 3) a water table at a depth of 1.0 foot or less during the growing season if saturated hydraulic conductivity (K_{sat}) is less than 6.0 in/hr in any layer within a depth of 20 inches.
3. Soils that are frequently ponded for periods of long or very long duration during the growing season.
4. Soils that are frequently flooded for periods of long or very long duration during the growing season.

Landscape, Parent Material, and West Virginia Grassland Suitability Class

Table 8 displays information about the relationships between soils and landscapes, landforms, parent materials, and the West Virginia grassland suitability class.

Percent of the map unit is the extent of the named soil in the map unit.

Slope is the inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The table shows the low and high range of slope for the named component or soil.

Elevation is the height of an object or area on the earth's surface in reference to a fixed point, such as mean sea level. The typical low and high range of elevation is displayed for each soil.

MAP is the mean annual precipitation for areas of the soil in the map unit.

Landscape refers to the broad shape of the earth in the area where the soil occurs. Examples are a valley and a mountain.

Landform is a specific shape of the earth in the area where a soil typically occurs. Examples are a mountain summit and a valley bottom.

Parent material is the material in which soils formed. Examples are the underlying geological material (including bedrock), a surficial deposit (such as volcanic ash), and organic material. Soils inherit their chemical and physical properties from the parent material.

West Virginia grassland suitability class names and numbers indicate groupings of soils which have similar capabilities for growing adapted herbaceous species and have similar responses to management. These groupings, when combined with climate and aspect, reflect the productive potential of soils and provide a guide to conservation and management decisions when permanent grassland is the land use objective. More information about West Virginia grassland suitability classes can be found in appendix 1.

Forest Productivity

Table 9 can help forestland owners or managers plan the use of soils for wood crops. It shows the potential productivity of the soils for wood crops.

Potential productivity of *characteristic trees* on a soil is expressed as a site index and as a volume number. Characteristic trees and other typical plant species are listed by common name in table 10 and by scientific name in table 11.

The *site index base age* indicates the age used for the site curves.

The *site index* is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that forestland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability. More detailed information regarding site index is available in the "National Forestry Manual," which is available in local offices of the Natural Resources Conservation Service or on the Internet.

The *volume of wood fiber*, a number, is the yield likely to be produced by the most important tree species. This number, expressed as cubic feet per acre per year and calculated at the age of culmination (CMAI), indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

Vegetation Map Classes

Dominant vegetation map classes are assigned to components of soil map units and are listed in the map unit descriptions under the heading "Interpretive

Groups." The soil components are correlated with the vegetation map classes which are published in "Vegetation Classification and Mapping of Gauley River National Recreation Area, West Virginia" (Technical Report NPS/NER/NRTR 2010/148). Appendix 2 is a complete copy of this report. The report is also available on the Internet at http://www.nps.gov/nero/science/FINAL/GARI_veg_map/GARI_veg_map.html.

All major soil components and miscellaneous land types (such as Rock outcrop) are correlated to one or more vegetation map classes. Each vegetation map class that is listed in the map unit description provides coverage of at least 15 percent of the total acreage of the soil map unit. For soil complexes, different vegetation classes were often correlated with different soil components, in accordance with the data. In a few soil map units, components of minor extent are correlated with a vegetation map class if the data indicates the existence of a unique relationship.

The U.S. National Vegetation Classification (USNVC) was used as the standard for vegetation classification (see appendix 2, pages 29-32). Map classes were also assigned to aquatic areas, disturbed areas, and cultural and transportation features. Other information on vegetation map classes can be found in appendix 2.

Land Management

In table 12, parts I through IV, interpretive ratings are given for various aspects of land management. The ratings are both verbal and numerical.

Some rating class terms indicate the degree to which the soils are suited to a specified land management practice. *Well suited* indicates that the soil has features that are favorable for the specified practice and has no limitations. Good performance can be expected, and little or no maintenance is needed. *Moderately suited* indicates that the soil has features that are moderately favorable for the specified practice. One or more soil properties are less than desirable, and fair performance can be expected. Some maintenance is needed. *Poorly suited* indicates that the soil has one or more properties that are unfavorable for the specified practice. Overcoming the unfavorable properties requires special design, extra maintenance, and costly alteration. *Unsuited* indicates that the expected performance of the soil is unacceptable for the specified practice or that extreme measures are needed to overcome the undesirable soil properties.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the specified land management practice (1.00) and the point at which the soil feature is not a limitation (0.00).

Rating class terms for *fire damage* and *seedling mortality* are expressed as low, moderate, and high. Where these terms are used, the numerical ratings indicate gradations between the point at which the potential for fire damage or seedling mortality is highest (1.00) and the point at which the potential is lowest (0.00).

Rating class terms for *hazard for erosion* are expressed as slight, moderate, severe, and very severe. Where these terms are used, the numerical ratings indicate gradations between the point at which the potential for erosion is highest (1.00) and the point at which the potential is lowest (0.00).

The paragraphs that follow indicate the soil properties considered in rating the soils for land management practices.

Part I (Planting)

Ratings in the columns *suitability for hand planting* and *suitability for mechanical planting* are based on slope, depth to a restrictive layer, content of sand, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding.

The soils are described as well suited, moderately suited, poorly suited, or unsuited to these methods of planting. It is assumed that necessary site preparation is completed before seedlings are planted.

Ratings in the column *soil rutting hazard* are based on depth to a water table, rock fragments on or below the surface, the Unified classification, depth to a restrictive layer, and slope. Ruts form as a result of the operation of planting equipment. The hazard is described as slight, moderate, or severe. A rating of *slight* indicates that the soil is subject to little or no rutting, *moderate* indicates that rutting is likely, and *severe* indicates that ruts form readily.

Part II (Hazard of Erosion and Suitability for Roads)

Ratings in the column *hazard of erosion* are based on slope and on soil erodibility factor K. The soil loss is caused by sheet or rill erosion in areas where 50 to 75 percent of the surface has been exposed by different kinds of disturbance. The hazard is described as slight, moderate, severe, or very severe. A rating of *slight* indicates that erosion is unlikely under ordinary climatic conditions; *moderate* indicates that some erosion is likely and that erosion-control measures may be needed; *severe* indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and *very severe* indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

Ratings in the column *hazard of erosion on roads and trails* are based on the soil erodibility factor K, slope, and content of rock fragments. The ratings apply to unsurfaced roads and trails. The hazard is described as slight, moderate, or severe. A rating of *slight* indicates that little or no erosion is likely; *moderate* indicates that some erosion is likely, that the roads or trails may require occasional maintenance and that simple erosion-control measures are needed; and *severe* indicates that significant erosion is expected, that the roads or trails require frequent maintenance, and that costly erosion-control measures are needed.

Ratings in the column *suitability for roads (natural surface)* are based on slope, rock fragments on the surface, plasticity index, content of sand, the Unified classification, depth to a water table, ponding, flooding, and the hazard of soil slippage. The ratings indicate the suitability for using the natural surface of the soil for roads. The soils are described as well suited, moderately suited, or poorly suited to this use.

Part III (Site Preparation)

Ratings in the column *suitability for mechanical site preparation (deep)* are based on slope, depth to a restrictive layer, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, poorly suited, or unsuited to this management activity. The part of the soil from the surface to a depth of about 3 feet is considered in the ratings.

Ratings in the column *suitability for mechanical site preparation (surface)* are based on slope, depth to a restrictive layer, plasticity index, rock fragments on or below the surface, depth to a water table, and ponding. The soils are described as well suited, poorly suited, or unsuited to this management activity. The part of the soil from the surface to a depth of about 1 foot is considered in the ratings.

Part IV (Site Restoration)

Ratings in the column *potential for damage to soil by fire* are based on texture of the surface layer, content of rock fragments and organic matter in the surface layer, thickness of the surface layer, and slope. The soils are described as having a low, moderate, or high potential for this kind of damage. The ratings indicate an evaluation of the potential impact of prescribed fires or wildfires that are intense enough to remove the duff layer and consume organic matter in the surface layer.

Ratings in the column *potential for seedling mortality* are based on flooding, ponding, depth to a water table, content of lime, reaction, salinity, available water capacity, soil moisture regime, soil temperature regime, aspect, and slope. The soils are described as having a low, moderate, or high potential for seedling mortality.

Recreation

The soils of the survey area are rated in table 13, parts I and II, according to limitations that affect their suitability for recreation. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The ratings in the table are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils that are subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

The information in table 13 can be supplemented by other information in this survey, for example, interpretations for building site development, construction materials, and water management.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas. The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic

areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Foot traffic and equestrian trails for hiking and horseback riding should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

Mountain bike and off-road vehicle trails require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, depth to a water table, ponding, slope, flooding, and texture of the surface layer.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, landscaping, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the “Soil Properties” section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about particle-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 7 feet of the surface, soil wetness, depth to a water table, ponding, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for septic tank absorption fields and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, ponds, and other structures for soil and water conservation; and predict performance of

proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Dwellings and Small Commercial Buildings

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Table 14 shows the degree and kind of soil limitations that affect dwellings and small commercial buildings.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Dwellings are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Roads and Streets, Shallow Excavations, and Landscaping

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Table 15 shows the degree and kind of soil limitations that affect local roads and streets, shallow excavations, and landscaping.

The ratings in the table are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

Landscaping requires soils on which turf, trees, and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

Sewage Disposal

Table 16 shows the degree and kind of soil limitations that affect septic tank absorption fields and sewage lagoons. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil

features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches or between a depth of 24 inches and a restrictive layer is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Saturated hydraulic conductivity (K_{sat}), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, saturated hydraulic conductivity (K_{sat}), depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Saturated hydraulic conductivity (K_{sat}) is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a K_{sat} rate of more than 14 micrometers per second are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

Source of Gravel and Sand

Table 17 gives information about the soils as potential sources of gravel and sand. Normal compaction, minor processing, and other standard construction practices are assumed.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. Only the likelihood of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material. The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains sand or gravel, the soil is considered a likely source regardless of thickness. The assumption is that the sand or gravel layer below the depth of observation exceeds the minimum thickness. The ratings are for the whole soil, from the surface to a depth of about 6 feet.

The soils are rated *good, fair,* or *poor* as potential sources of sand and gravel. A rating of *good* or *fair* means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of sand or gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

Source of Reclamation Material, Roadfill, and Topsoil

Table 18 gives information about the soils as potential sources of reclamation material, roadfill, and topsoil. Normal compaction, minor processing, and other standard construction practices are assumed.

The soils are rated *good, fair,* or *poor* as potential sources of reclamation material, roadfill, and topsoil. The features that limit the soils as sources of these materials are specified in the table. Numerical ratings between 0.00 and 0.99 are given after the specified features. These numbers indicate the degree to which the features limit the soils as sources of topsoil, reclamation material, or roadfill. The lower the number, the greater the limitation as a potential source.

Reclamation material is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments. The ratings are for the whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also

evaluated is the reclamation potential of the borrow area. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Ponds and Embankments

Table 19 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the saturated hydraulic conductivity (K_{sat}) of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. Embankments that have zoned construction (core and shell) are not considered. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are

fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, K_{sat} of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey.

Soil properties are ascertained by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine particle-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties are shown in tables. They include engineering properties, physical and chemical properties, and pertinent soil and water features.

Engineering Properties

Table 20 gives the engineering classifications and the range of engineering properties for the layers of each soil in the park.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement,

the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 250 millimeters in diameter and 75 to 250 millimeters in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical Soil Properties

Table 21 shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the park. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller. If a range is not present, a singular representative value is shown.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (K_{sat}), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^1/_3$- or $^1/_{10}$-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility,

shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability (K_{sat}) refers to the ability of a soil to transmit water or air. The estimates in the table indicate the rate of water movement, in micrometers per second, when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Shrink-swell potential is the potential of the soil to expand and contract with a loss or gain in moisture. Linear extensibility is used to determine the shrink-swell potential of soils. Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at $^1/_3$- or $^1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

The shrink-swell potential is *low* if the soil has a linear extensibility of less than 3 percent; *moderate* if 3 to 6 percent; *high* if 6 to 9 percent; and *very high* if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion Properties

Table 22 shows estimates of some erosion factors that affect a soil's potential for different uses. These estimates are given for each layer of every soil for K factors and are given as one rating for the entire soil for the T factor. Values are reported for each soil in the park. Estimates are based on field observations and on test data for these and similar soils.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and K_{sat}. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

The procedure for determining the Kf factor is outlined in Agriculture Handbook 703, “Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE),” USDA, Agricultural Research Service, 1997.

Depth to the upper and lower boundaries of each layer is indicated.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments. In horizons where total rock fragments are 15 percent or more, by volume, the Kw factor is always less than the Kf factor.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size. Soil horizons that do not have rock fragments are assigned equal Kw and Kf factors.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the “National Soil Survey Handbook.”

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Total Soil Carbon

Table 23 gives estimates of total soil carbon. Soil carbon occurs as organic and inorganic carbon.

Soil organic carbon (SOC) is carbon (C) in soil that originated from a biological source, such as plants, animals, or micro-organisms. SOC is found in both organic and mineral soil layers. The term “soil organic carbon” refers only to the carbon occurring in soil organic matter (SOM). Soil organic carbon makes up about one-half the weight of soil organic matter. The rest of SOM is mostly oxygen, nitrogen, and hydrogen.

Soil inorganic carbon (SIC) is carbon found in soil carbonates, typically as calcium carbonate layers in the soil or as clay-sized fractions throughout the soil. Carbonates in soils are most common in areas where evaporation rates exceed precipitation, as is the case in most desert environments. Typically, the carbonates accumulated from carbonatic dust or from solution during periods of wetter climates. Soil inorganic carbon also occurs in soils that formed in marl in all regions of the country.

The SOC and SIC contents are reported in kilograms per square meter to a depth of 2 meters or to a representative depth of either hard bedrock or a cemented horizon. The SOC and SIC values are on a whole soil basis, corrected for rock fragments.

SOC can be an indicator of overall soil fertility and soil quality that affects ecosystem function. SOM is the main reservoir for most plant nutrients, such as phosphorus and nitrogen. Managing for SOC by managing for SOM increases the content of these elements and improves soil resiliency.

Soil organic matter binds soil particles together and thus increases soil porosity and water infiltration and allows better root penetration and waterflow into the soil. Greater inflow of water reduces the hazard of erosion and the rate of surface water runoff.

Greater SOC levels improve not only soil quality but also the quality of air and water. Soil acts as a filter and improves water quality. Fertile soils that support plant life remove CO_2 from the atmosphere and increase oxygen levels through photosynthesis. Maintaining the level of soil organic carbon reduces C release into the atmosphere and thus can lessen the effects of global warming.

SIC influences the types of plants that will grow. High SIC levels are commonly associated with a higher soil pH, which limits the types of plants that will thrive.

Like SOM, soil carbonates, the source of SIC, also bind soil particles together. They fill voids in the soil and thus can reduce soil porosity. Compacted soil carbonates may restrict root penetration and waterflow into the soil.

Chemical Soil Properties

Table 24 shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Effective cation-exchange capacity refers to the sum of extractable cations plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

Soil reaction is a measure of acidity or alkalinity. The pH of each soil horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Water Features

Table 25 gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

The *months* in the table indicate the portion of the year in which a water table, ponding, and/or flooding is most likely to be a concern.

Water table refers to a saturated zone in the soil. Table 25 indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Soil Features

Table 26 gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the kind and thickness of the restrictive layer, both of which significantly affect the ease of excavation. If no restriction exists the table reports *No restriction*. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, saturated hydraulic conductivity (K_{sat}), content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2010). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The names for the orders and taxonomic soil properties relate to Greek, Latin, or other root words that reveal something about the soil. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Inceptisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udept (*Ud*, meaning humid, plus *ept*, from Inceptisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Dystrudepts (*Dystr*, meaning infertile, plus *udept*, the suborder of the Inceptisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Dystrudepts.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Most parks are mapped to the series level. The names of soil series are selected by the soil scientists during the course of mapping. The series names are commonly geographic place names or are coined. Because of access limitations and soil

variability, soils in some remote areas are classified at the great group or subgroup level.

Table 27 indicates the order, suborder, great group, subgroup, and family of the soil series in the park. Table 28 displays classification as a key sorted by soil order.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the “Soil Survey Manual” (Soil Survey Division Staff, 1993). Many of the technical terms used in the descriptions are defined in “Soil Taxonomy” (Soil Survey Staff, 1999) and in “Keys to Soil Taxonomy” (Soil Survey Staff, 2010). Unless otherwise indicated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

Allegheny Series

The Allegheny series consists of very deep, well drained soils that formed in alluvium from interbedded Pennsylvanian-age sandstone, shale, and siltstone. Allegheny soils are on high stream terraces in river valleys. Slopes range from 8 to 15 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Fine-loamy, mixed, semiactive, mesic Typic Hapludults

Typical Pedon

Allegheny loam; Fayette County, West Virginia; on a 9 percent slope in a forested area on Koontz Bend of the Gauley River, about 1.77 kilometers (1.1 miles) northeast of the mouth of Peters Creek; at an elevation of 323 meters (1,060 feet); lat. 38 degrees 14 minutes 19 seconds N. and long. 81 degrees 02 minutes 09 seconds W.; NAD83; Ansted, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

Oi—0 to 1 centimeter (0 to 0.4 inch); slightly decomposed plant material; abrupt irregular boundary.

Oe—1 to 4 centimeters (0.4 inch to 2 inches); moderately decomposed plant material; loose; abrupt smooth boundary.

A—4 to 7 centimeters (2 to 3 inches); dark brown (10YR 3/3), broken face, loam; weak fine granular structure; very friable; many very fine to medium roots; very strongly acid, pH 4.8 by Hellige-Truog; abrupt wavy boundary.

Ap—7 to 26 centimeters (3 to 10 inches); brown (10YR 4/3), broken face, loam; moderate medium granular structure; very friable; common very fine to coarse roots; very strongly acid, pH 4.9 by Hellige-Truog; abrupt smooth boundary.

BE—26 to 42 centimeters (10 to 17 inches); yellowish brown (10YR 5/4), broken face, loam; weak medium subangular blocky structure; friable; common very fine to very coarse roots; 3 percent nonflat subrounded very strongly cemented sandstone gravel; very strongly acid, pH 4.6 by Hellige-Truog; clear wavy boundary.

Bt1—42 to 73 centimeters (17 to 29 inches); brownish yellow (10YR 6/6), broken face, loam; 25 percent clay; moderate medium subangular blocky structure; friable; 10 percent clay films on all faces of peds; very strongly acid, pH 4.5 by Hellige-Truog; clear wavy boundary.

Bt2—73 to 87 centimeters (29 to 34 inches); yellowish brown (10YR 5/6), broken face, clay loam; 32 percent clay; moderate medium subangular blocky structure; friable; 30 percent clay films on all faces of peds; extremely acid, pH 4.3 by Hellige-Truog; clear wavy boundary.
Bt3—87 to 127 centimeters (34 to 50 inches); yellowish brown (10YR 5/6), broken face, clay loam; 36 percent clay; moderate coarse subangular blocky structure; firm; 55 percent clay films on all faces of peds; extremely acid, pH 4.1 by Hellige-Truog; gradual wavy boundary.
Bt4—127 to 165 centimeters (50 to 65 inches); strong brown (7.5YR 5/6), broken face, clay loam; 28 percent clay; weak coarse subangular blocky structure; firm; 45 percent clay films on all faces of peds; extremely acid, pH 4.0 by Hellige-Truog.

Range in Characteristics

Solum thickness: 102 to 203 centimeters (30 to 72 inches)
Depth to bedrock: More than 152 centimeters (60 inches)
Rock fragment content: 0 to 15 percent of the A horizon, 0 to 30 percent of the Bt horizon, and 0 to 35 percent of the BC and C horizons; mostly sandstone gravel or channers
Soil reaction: Strongly acid to extremely acid

The A horizon (if it occurs) has hue of 7.5YR to 2.5Y, value of 3, and chroma of 1 to 3. It is loam, fine sandy loam, or silt loam.

The Ap horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is loam, fine sandy loam, or silt loam. Some pedons have thin A horizons that include value of 3 and chroma of 1 to 3.

The BA or BE horizon (if it occurs) has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 8. Texture is sandy loam, loam, or silt loam.

The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 8. It is clay loam, sandy clay loam, loam, fine sandy loam, silt loam, or silty clay loam. Faint mottles in shades of brown, red, or yellow are common in the lower part of the horizon.

The BC horizon (if it occurs) generally has colors and textures similar to those of the lower Bt horizon. Iron-manganese concretions and iron masses in shades of brown, red, or yellow increase in number as depth increases. Some horizons are variegated without dominant hue or chroma.

The C horizon (if it occurs) has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 8 and may be variegated. It ranges from sand to clay loam and may be stratified. Iron masses, nodules, concretions, and iron depletions in shades of black, brown, yellow, gray, or olive are common throughout the horizon.

Some pedons have a 2BC or 2C horizon. This horizon has 35 to 80 percent gravel and cobbles and/or strongly contrasting particle size compared to overlying horizons.

Berks Series

The Berks series consists of moderately deep, well drained soils that formed in residuum weathered from interbedded Pennsylvanian-age shale, siltstone, and fine grained sandstone (Kanawha Formation) (fig. 19). Berks soils are on convex mountain slopes. Slopes range from 35 to 80 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Loamy-skeletal, mixed, active, mesic Typic Dystrudepts

Figure 19.—A representative profile of the Berks series. Berks soils are 51 to 102 centimeters (20 to 40 inches) deep to bedrock. In this photo, fractured siltstone bedrock occurs at a depth of approximately 80 centimeters (31 inches). The photo is from Pocahontas County, West Virginia. Scale is in centimeters.

Typical Pedon

Berks channery silt loam; Fayette County, West Virginia; on a 51 percent slope in a forested area, about 724 meters (2,375 feet) southeast of the confluence of Peters Creek and the Gauley River; at an elevation of 463 meters (1,519 feet); lat. 38 degrees 13 minutes 08 seconds N. and long. 81 degrees 02 minutes 35 seconds W.; NAD83; Ansted, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

Oi—0 to 3 centimeters (0 to 1 inch); slightly decomposed plant material; abrupt wavy boundary.

A—3 to 13 centimeters (1 to 5 inches); dark brown (10YR 3/3), crushed, channery silt loam; 19 percent clay; moderate fine and medium granular structure; very friable; 15 percent flat subangular moderately cemented shale channers; very strongly acid, pH 4.6 by Hellige-Truog; clear wavy boundary.

BA—13 to 24 centimeters (5 to 9 inches); dark yellowish brown (10YR 4/4), broken face, channery silt loam; 20 percent clay; weak medium subangular blocky structure; friable; common fine, common medium, common coarse, common very coarse, and common very fine roots throughout; 25 percent shale channers; very strongly acid, pH 4.5 by Hellige-Truog; clear wavy boundary.

Bw1—24 to 53 centimeters (9 to 21 inches); yellowish brown (10YR 5/6), broken face, very channery silt loam; 22 percent clay; moderate medium subangular blocky structure; friable; common medium, common coarse, and few very fine roots throughout; 10 percent flat subangular strongly cemented shale flagstones and 25 percent flat subangular moderately cemented shale channers; very strongly acid, pH 4.8 by Hellige-Truog; clear wavy boundary.

Bw2—53 to 75 centimeters (21 to 30 inches); yellowish brown (10YR 5/6), broken face and moist, very channery silt loam; 22 percent clay; weak medium subangular blocky structure; friable; few fine, few medium, and few coarse roots throughout; 40 percent flat subangular moderately cemented shale channers; very strongly acid, pH 4.8 by Hellige-Truog; clear wavy boundary.

Bw3—75 to 85 centimeters (30 to 33 inches); yellowish brown (10YR 5/4), broken face, very channery silt loam; 23 percent clay; 1 percent fine prominent dark yellowish brown (10YR 4/6) and 1 percent fine prominent brown (10YR 5/3) mottles; weak coarse subangular blocky structure; friable; 10 percent flat subangular strongly cemented shale flagstones and 35 percent flat subangular moderately cemented shale channers; very strongly acid, pH 4.8 by Hellige-Truog; gradual wavy boundary.

C—85 to 94 centimeters (33 to 37 inches); yellowish brown (10YR 5/4), broken face, very channery silt loam; 23 percent clay; 1 percent fine prominent dark yellowish brown (10YR 4/6) and 1 percent fine prominent brown (10YR 5/3) mottles; massive; friable; 40 percent flat subangular moderately cemented shale channers; very strongly acid, pH 4.8 by Hellige-Truog; clear wavy boundary.

Cr—94 to 109 centimeters (37 to 43 inches); yellowish brown (10YR 5/4) weathered shale bedrock; moderate excavation difficulty; abrupt wavy boundary.

R—109 centimeters (43 inches); unweathered shale bedrock; high excavation difficulty.

Range in Characteristics

Solum thickness: 30 to 102 centimeters (12 to 40 inches)
Depth to bedrock: 50 to 102 centimeters (20 to 40 inches)
Content of rock fragments: 10 to 50 percent in the A horizon, 15 to 75 percent in individual subhorizons of B horizons, and 35 to 90 percent in the C horizon; average volume in the particle-size control section is more than 35 percent
Soil reaction: Extremely acid to slightly acid throughout the profile

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. Texture of the fine-earth fraction is loam or silt loam.

The B horizons have hue of 5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 8. Hue of 5YR is restricted to the lower part of the soil. Texture of the fine-earth fraction is loam, silt loam, or silty clay loam. The horizons contain 5 to 32 percent clay and 40 to 60 percent silt. Structure is weak or moderate fine or medium subangular blocky in a Bw horizon and is usually obscured by rock fragments in a CB horizon.

The C horizon (if it occurs) has hue of 5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 8. Texture of the fine-earth fraction is loam or silt loam.

Buchanan Series

The Buchanan series consists of very deep, somewhat poorly drained and moderately well drained soils that formed in colluvium derived from Pennsylvanian-age sandstone, siltstone, and shale (fig. 20). Buchanan soils are on mountain footslopes and in drainageways. Slopes range from 8 to 15 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Fine-loamy, mixed, semiactive, mesic Aquic Fragiudults

Typical Pedon

Buchanan loam; Nicholas County, West Virginia; on a 8 percent slope in a forested area along County Route 22/1, about 2.95 kilometers (1.8 miles) southwest of Keslers Cross Lanes and 1.01 kilometers (0.63 mile) northeast of the confluence of Meadow Creek and the Gauley River; at an elevation of 467 meters (1,532 feet); lat. 38 degrees 13 minutes 27 seconds N. and long. 80 degrees 57 minutes 57 seconds W.; NAD83; Summersville Dam, West Virginia USGS topographic quadrangle: (When described, the soil was moist throughout.)

A—0 to 12 centimeters (0 to 5 inches); dark brown (10YR 3/3), broken face, loam; weak fine granular structure; very friable; many fine and very fine roots; 3 percent nonflat subangular very strongly cemented sandstone gravel and 8 percent flat subangular very strongly cemented sandstone channers; very strongly acid, pH 4.5 by Hellige-Truog; abrupt wavy boundary.

BA—12 to 20 centimeters (5 to 8 inches); dark yellowish brown (10YR 4/4), broken face, loam; weak medium subangular blocky structure; very friable; few very fine to medium roots; 3 percent nonflat subangular very strongly cemented sandstone gravel; very strongly acid, pH 4.5 by Hellige-Truog; clear wavy boundary.

Bt1—20 to 40 centimeters (8 to 16 inches); yellowish brown (10YR 5/6), broken face, loam; moderate medium subangular blocky structure; friable; few very fine and fine roots; 10 percent clay films on vertical faces of peds; extremely acid, pH 4.3 by Hellige-Truog; clear smooth boundary.

Bt2—40 to 65 centimeters (16 to 26 inches); brownish yellow (10YR 6/6), broken face, loam; moderate medium subangular blocky structure; friable; few very fine to coarse roots throughout; 15 percent clay films on vertical faces of peds; 1 percent fine prominent strong brown (7.5YR 4/6) masses of oxidized iron in matrix surrounding redoximorphic depletions and 2 percent medium prominent light gray (10YR 7/2) iron depletions infused into matrix along faces of peds; 5 percent nonflat subangular very strongly cemented sandstone gravel; very strongly acid, pH 4.6 by Hellige-Truog; clear smooth boundary.

Btx1—65 to 98 centimeters (26 to 39 inches); brownish yellow (10YR 6/8), broken face, loam; weak very coarse prismatic structure parting to moderate coarse platy;

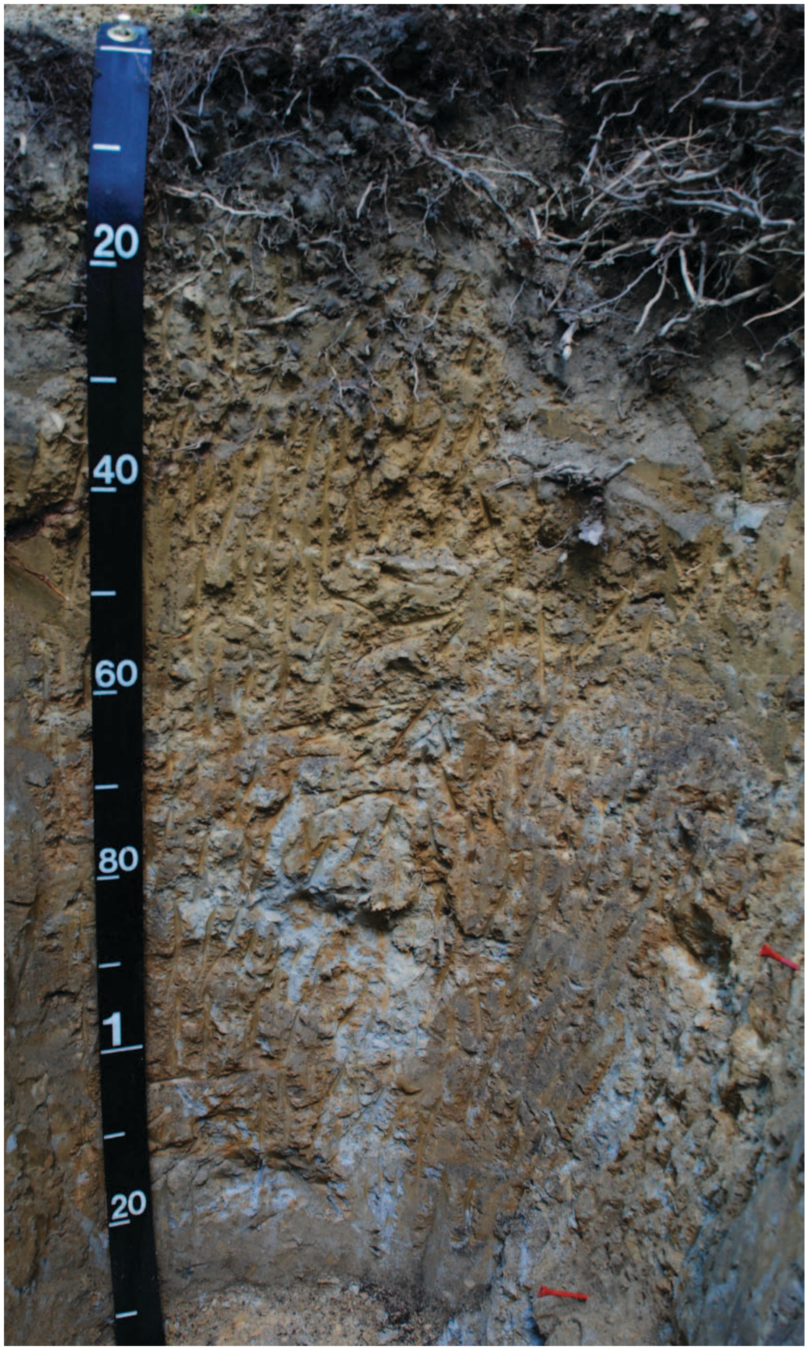

Figure 20.—A representative profile of the Buchanan series. Buchanan soils have a dense layer in the subsoil called a fragipan (Btx horizon) which impedes root penetration and the movement of water downward through the soil profile. In this photo, the fragipan begins at a depth of 55 centimeters (22 inches). The photo is from Monongalia County, West Virginia. Scale is in centimeters.

firm; brittle; few very fine roots between peds; 15 percent clay films on vertical faces of peds; 3 percent fine prominent strong brown (7.5YR 5/8) masses of oxidized iron in matrix surrounding redoximorphic depletions and 4 percent coarse prominent light gray (10YR 7/2) iron depletions between peds; 9 percent nonflat

subangular very strongly cemented sandstone gravel; very strongly acid, pH 4.5 by Hellige-Truog; clear smooth boundary.

Btx2—98 to 165 centimeters (39 to 65 inches); light yellowish brown (10YR 6/4), broken face, clay loam; moderate very coarse prismatic structure parting to moderate coarse platy; very firm; brittle; 10 percent clay films on vertical faces of peds; 15 percent fine prominent strong brown (7.5YR 5/8) masses of oxidized iron in matrix surrounding redoximorphic depletions and 20 percent very coarse prominent light gray (10YR 7/2) iron depletions between peds; 10 percent nonflat subangular very strongly cemented sandstone gravel; very strongly acid, pH 4.5 by Hellige-Truog.

Range in Characteristics

Solum thickness: 102 to 203 centimeters (40 to 80 inches)
Depth to bedrock: More than 152 centimeters (60 inches)
Depth to the fragipan: 51 to 91 centimeters (20 to 36 inches)
Rock fragments: 0 to 40 percent in individual horizons above the fragipan and 5 to 60 percent in the fragipan and C horizon; typically 10 to 15 percent of the soil, by volume, with higher amounts in the surface layer; channers, gravel, cobbles, and stones; subrounded and flat subangular hard sandstone and shale
Soil reaction: Extremely acid to strongly acid throughout the profile

The A horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 1 to 4. Texture of the fine-earth fraction is fine sandy loam, sandy loam, silt loam, or loam.

An E horizon occurs in some pedons. It has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. Texture of the fine-earth fraction is sandy loam, silt loam, or loam.

A BE or BA horizon occurs in some pedons. This horizon has hue of 10YR or 7.5YR and value and chroma of 5 or 6. Texture of the fine-earth fraction is silt loam or loam.

The Bt horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 3 to 6. It has low-chroma redoximorphic features in the lower part. Texture of the fine-earth fraction is silt loam, loam, clay loam, or sandy clay loam. The horizon has 18 to 30 percent clay and more than 20 percent sand. It has few to many clay films.

The Btx horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 3 to 6. It has few to many redoximorphic concentrations and depletions. Texture of the fine-earth fraction is silt loam, loam, clay loam, or sandy clay loam. The horizon has weak or moderate prismatic structure parting to platy or blocky structure and is firm or very firm and brittle.

The C horizon (if it occurs) has hue of 2.5Y to 5YR, value of 4 to 6, and chroma of 1 to 6. Texture of the fine-earth fraction is sandy loam, silt loam, loam, clay loam, or sandy clay loam.

Clifftop Series

The Clifftop series consists of moderately deep, well drained soils that formed in residuum from Pennsylvanian-age acid shale, siltstone, and fine grained sandstone (fig. 21). Clifftop soils are on mountain ridges and slopes. Slopes range from 3 to 70 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Fine-loamy, mixed, semiactive, mesic Typic Hapludults

Figure 21.—A representative profile of the Clifftop series. Clifftop soils are 51 to 102 centimeters (20 to 40 inches) deep to bedrock. In this photo, fractured fine grained sandstone bedrock occurs at a depth of approximately 60 centimeters (24 inches). The photo is from Preston County, West Virginia. Scale is in centimeters.

Typical Pedon

Clifftop channery silt loam; Fayette County, West Virginia; on a 10 percent slope in a hayfield about 270 meters (885 feet) southeast of the end of County Route 3/2 (White Road) and 1,046 meters (3,432 feet) southwest of the confluence of Masons Branch and the Gauley River; the site is underlain by the Upper Nuttall sandstone; at an elevation of 427 meters (1,401 feet); lat. 38 degrees 13 minutes 06.4 seconds N. and long. 81 degrees 00 minutes 04.8 seconds W.; NAD83; Ansted, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

Ap—0 to 18 centimeters (0 to 7 inches); brown (10YR 4/3), broken face, channery silt loam; moderate medium granular structure; friable, slightly sticky, slightly plastic; common fine and many very fine roots; 15 percent flat subrounded moderately

cemented acid shale channers 2 to 150 millimeters in size; strongly acid, pH 5.2 by Hellige-Truog; abrupt smooth boundary.

BA—18 to 28 centimeters (7 to 11 inches); dark yellowish brown (10YR 4/4), broken face, silt loam; 20 percent clay; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few fine and common very fine roots; 5 percent flat subrounded moderately cemented acid shale channers 2 to 150 millimeters in size; very strongly acid, pH 4.9 by Hellige-Truog; clear wavy boundary.

Bt—28 to 51 centimeters (11 to 20 inches); yellowish brown (10YR 5/4), broken face, loam; 23 percent clay; 10 percent coarse prominent brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; friable, slightly sticky, slightly plastic; few fine and few very fine roots; 10 percent flat subrounded moderately cemented acid shale channers 2 to 150 millimeters in size; very strongly acid, pH 4.8 by Hellige-Truog; clear wavy boundary.

BC—51 to 61 centimeters (20 to 24 inches); yellowish brown (10YR 5/4), broken face, channery loam; 19 percent clay; 15 percent coarse prominent brownish yellow (10YR 6/8) mottles; weak coarse subangular blocky structure; firm, slightly sticky, slightly plastic; 20 percent flat subrounded moderately cemented acid shale channers 2 to 150 millimeters in size; very strongly acid, pH 4.6 by Hellige-Truog; gradual wavy boundary.

Cr—61 centimeters (24 inches); light yellowish brown (2.5Y 6/3) moderately cemented acid shale bedrock; moderate excavation difficulty.

Range in Characteristics

Depth to bedrock: 51 to 102 centimeters (20 to 40 inches)

Content of rock fragments: 0 to 25 percent in the upper part of the solum and 15 to 65 percent in the BC and C horizons

Soil reaction: Strongly acid to extremely acid throughout the profile

The A or Ap horizon has hue of 10YR or 2.5Y, value of 2 to 5, and chroma of 1 to 4. Texture of the fine-earth fraction is silt loam or loam.

The BA horizon (or similar transitional horizon) has hue of 7.5YR to 2.5Y, value of 3 to 6 (6 or more dry), and chroma of 3 to 6. Texture of the fine-earth fraction is silt loam or loam.

The E horizon (if it occurs) has hue of 10YR to 2.5Y, value of 4 to 6 (6 or more dry), and chroma of 2 to 6. Texture of the fine-earth fraction is silt loam or loam.

The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. Texture of the fine-earth fraction is silt loam, silty clay loam, clay loam, or loam.

The BC horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. Texture of the fine-earth fraction is silt loam, silty clay loam, clay loam, or loam.

The C horizon (if it occurs) has hue of 7.5YR to 2.5Y and value and chroma of 4 to 8. Texture of the fine-earth fraction is silt loam, silty clay loam, silty clay, clay loam, or loam. Lithochromic colors in shades of yellowish brown, gray, and reddish brown may occur.

Cottonbend Series

The Cottonbend series consists of very deep, well drained soils that formed in old alluvium derived mainly from Pennsylvanian-age sandstone, siltstone, and shale. Cottonbend soils are on high stream terraces in river valleys. Slopes range from 3 to 15 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Fine-loamy, siliceous, semiactive, mesic Typic Paleudults

Typical Pedon

Cottonbend loam; Fayette County, West Virginia; on a 3 percent slope in a forested area on Koontz Bend of the Gauley River, about 381 meters (1,250 feet) west-southwest (bearing 258 degrees) of the confluence of Bucklick Branch and the Gauley River; at an elevation of 347 meters (1,138 feet); lat. 38 degrees 14 minutes 08 seconds N. and long. 81 degrees 01 minute 54 seconds W.; NAD83; Ansted, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

Oi—0 to 1 centimeter (0 to 0.4 inch); slightly decomposed plant material; abrupt wavy boundary.

A—1 to 8 centimeters (0.4 inch to 3 inches); dark brown (10YR 3/3), broken face, loam; 10 percent clay; moderate medium granular structure; very friable; many very fine to medium and common coarse to very coarse roots throughout; strongly acid, pH 5.5 by Hellige-Truog; clear wavy boundary.

Ap—8 to 20 centimeters (3 to 8 inches); brown (10YR 4/3), broken face, loam; 10 percent clay; moderate coarse and moderate medium subangular blocky structure; friable; many very fine, many medium, and common coarse roots throughout; strongly acid, pH 5.5 by Hellige-Truog; abrupt smooth boundary.

Bt1—20 to 61 centimeters (8 to 24 inches); yellowish brown (10YR 5/6), broken face, loam; 17 percent clay; weak medium subangular blocky structure; friable; common very fine and medium roots throughout; 3 percent faint clay films on all faces of peds; very strongly acid, pH 4.5 by Hellige-Truog; clear wavy boundary.

Bt2—61 to 77 centimeters (24 to 30 inches); strong brown (7.5YR 5/6), broken face, loam; 20 percent clay; moderate medium subangular blocky structure parting to moderate fine granular and moderate medium subangular blocky structure parting to moderate medium granular; firm; common medium and common very fine roots throughout; 10 percent distinct clay films on all faces of peds; extremely acid, pH 4.0 by Hellige-Truog; clear smooth boundary.

Bt3—77 to 102 centimeters (30 to 40 inches); strong brown (7.5YR 5/6), broken face, loam; 23 percent clay; moderate coarse subangular blocky structure parting to moderate medium granular and moderate medium subangular blocky structure parting to moderate medium granular; firm; common very fine to coarse roots throughout; 7 percent distinct clay films on all faces of peds; extremely acid, pH 4.0 by Hellige-Truog; clear smooth boundary.

Bt4—102 to 128 centimeters (40 to 50 inches); reddish brown (2.5YR 5/4), broken face, loam; 21 percent clay; moderate medium granular and moderate coarse subangular blocky structure; friable; common very fine and medium roots throughout; 20 percent distinct clay films on all faces of peds; extremely acid, pH 3.6 by Hellige-Truog; clear smooth boundary.

Bt5—128 to 230 centimeters (50 to 91 inches); red (2.5YR 4/6), broken face, loam; 20 percent clay; moderate coarse platy structure parting to weak coarse subangular blocky and moderate medium platy structure parting to weak coarse subangular blocky; friable; common very fine and medium roots throughout; 45 percent distinct clay films on all faces of peds; extremely acid, pH 3.6 by Hellige-Truog; gradual wavy boundary.

BC—230 to 332 centimeters (91 to 131 inches); red (2.5YR 4/8), broken face, sandy loam; 8 percent clay; weak coarse platy structure; very friable; common very coarse roots between peds and common very fine to medium roots throughout; extremely acid, pH 3.6 by Hellige-Truog; gradual wavy boundary.

CB1—332 to 367 centimeters (131 to 144 inches); yellowish red (5YR 4/6), broken face, loamy sand; 5 percent clay; massive; extremely acid, pH 3.6 by Hellige-Truog; diffuse wavy boundary.

CB2—367 to 440 centimeters (144 to 173 inches); yellowish red (5YR 4/6), broken face, gravelly loamy sand with gravel; massive; extremely acid, pH 3.6 by Hellige-Truog; gradual wavy boundary.

C—440 to 465 centimeters (173 to 183 inches); strong brown (7.5YR 5/6), broken face, loamy sand with paragravel; massive; extremely acid, pH 3.6 by Hellige-Truog.

Range in Characteristics

Solum thickness: More than 203 centimeters (72 inches)
Depth to bedrock: More than 152 centimeters (60 inches)
Rock fragments: 0 to 35 percent in the upper part of the solum and 0 to 60 percent below a depth of about 24 inches; gravel and cobbles; mostly well rounded sandstone, siltstone, and shale
Soil reaction: Extremely acid to strongly acid throughout the profile

The A or Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. Some pedons have a thin Ap horizon with value of 3. Texture is loam, silt loam, or fine sandy loam.

The E or BE horizon (if it occurs) has hue of 7.5YR to 2.5Y, value of 5 or 6, and chroma of 4 to 8. Texture is loam, sandy loam, or fine sandy loam.

The upper part of the Bt horizon (above a depth of about 24 inches) has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. Texture is dominantly sandy clay loam, loam, clay loam, or, rarely, silty clay loam.

The lower part of the Bt horizon (below a depth of about 24 inches) has hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 4 to 8. Soft iron masses in shades or brown or red are common throughout. Texture is loam, clay loam, sandy clay loam, or clay.

The CB and/or C horizons have hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 4 to 8. Texture is loam, clay loam, sandy clay loam, or clay.

Craigsville Series

The Craigsville series consists of very deep, well drained soils that formed in acid, sandy and gravelly alluvium derived from Pennsylvanian-age sandstone, shale, and siltstone. Craigsville soils are on high-energy flood plains in river valleys. Slopes range from 0 to 3 percent. The mean annual precipitation is 1,207 millimeters (47.5 inches), and the mean annual air temperature is 10.6 degrees C (51 degrees F).

Taxonomic Classification

Loamy-skeletal, mixed, superactive, mesic Fluventic Dystrudepts

Typical Pedon

Craigsville very stony sandy loam; Raleigh County, West Virginia; on a 2 percent slope in a forested area near the mouth of Glade Creek; at an elevation of 372 meters (1,220 feet); lat. 37 degrees 49 minutes 43 seconds N. and long. 81 degrees 00 minutes 46 seconds W.; NAD83; Prince, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

Oi—0 to 2 centimeters (0 to 1 inch); slightly decomposed plant material; abrupt smooth boundary.

Oe—2 to 3 centimeters (1 to 1.4 inches); moderately decomposed plant material; abrupt broken boundary.

A—3 to 13 centimeters (1.4 to 5 inches); very dark brown (10YR 2/2), crushed, very stony sandy loam; 7 percent clay; weak fine and medium granular structure; very

friable; many fine to very coarse roots throughout; 10 percent nonflat rounded indurated sandstone cobbles and 35 percent nonflat rounded indurated sandstone stones; very strongly acid, pH 4.5 by Hellige-Truog; abrupt smooth boundary.

Bw1—13 to 30 centimeters (5 to 12 inches); dark brown (7.5YR 3/4), broken face, very stony sandy loam; 7 percent clay; weak fine and medium subangular blocky structure; very friable; many fine to very coarse roots throughout; 11 percent nonflat rounded indurated sandstone cobbles and 44 percent nonflat rounded indurated sandstone stones; very strongly acid, pH 4.5 by Hellige-Truog; clear wavy boundary.

Bw2—30 to 52 centimeters (12 to 20 inches); brown (7.5YR 4/4), broken face, extremely stony sandy loam; 5 percent clay; weak medium subangular blocky structure; very friable; common fine and medium roots throughout; 12 percent nonflat rounded indurated sandstone cobbles and 48 percent nonflat rounded indurated sandstone stones; very strongly acid, pH 4.5 by Hellige-Truog; gradual wavy boundary.

C—52 to 165 centimeters (20 to 65 inches); strong brown (7.5YR 4/6), crushed, extremely stony loamy sand; 3 percent clay; single grain; loose; few fine roots throughout; 15 percent nonflat rounded indurated sandstone cobbles and 60 percent nonflat rounded indurated sandstone stones; very strongly acid, pH 4.5 by Hellige-Truog.

Range in Characteristics

Solum thickness: 51 to 102 centimeters (20 to 40 inches)
Depth to bedrock: More than 152 centimeters (60 inches)
Rock fragments: 5 to 60 percent, by volume, in the A horizon and 35 to 75 percent in the B and C horizons; gravel, cobbles, and stones
Soil reaction: Very strongly acid or strongly acid

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 4. Texture of the fine-earth fraction ranges from sandy loam to silt loam.

The B horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 4 or 6. Texture of the fine-earth fraction is loam or sandy loam.

The BC horizon (if it occurs) has hue of 5YR to 10YR, value of 4 or 5, and chroma of 4 or 6. Texture of the fine-earth fraction is loam, sandy loam, or loamy sand.

The C or 2C horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 to 6. Texture of the fine-earth fraction is loamy sand or sandy loam. Thin, nonconforming horizons may have less than 15 percent gravel or cobbles.

Dekalb Series

The Dekalb series consists of moderately deep, well drained soils that formed in residuum weathered from Pennsylvanian-age, acid sandstone (fig. 22). Dekalb soils are on nearly level to steep convex mountain summits, crests, and upper flanks. Slopes range from 3 to 35 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Loamy-skeletal, siliceous, active, mesic Typic Dystrudepts

Typical Pedon

Dekalb very channery sandy loam; Fayette County, West Virginia; on a 47 percent slope in a forested area about 805 meters (2,641 feet) north of the community of Ames Heights and 115 meters (377 feet) west of Mill Creek; at an elevation of 488 meters (1,601 feet); lat. 38 degrees 05 minutes 30 seconds N. and long. 81 degrees

Figure 22.—A representative profile of the Dekalb series. Dekalb soils are 51 to 102 centimeters (20 to 40 inches) deep to sandstone bedrock. In this photo, bedrock occurs at a depth of approximately 58 centimeters (23 inches). The photo is from Fayette County, West Virginia.

04 minutes 30 seconds W.; NAD83; Fayetteville, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

Oi—0 to 2 centimeters (0 to 1 inch); slightly decomposed plant material; strongly acid, pH 5.4, 1:1 water; abrupt wavy boundary.

Oe—2 to 5 centimeters (1 to 2 inches); moderately decomposed plant material; very strongly acid, pH 4.8, 1:1 water; abrupt wavy boundary.

A—5 to 12 centimeters (2 to 5 inches); black (7.5YR 2.5/1), broken face, very channery highly organic sandy loam; moderate medium granular structure; very friable; 55 percent sandstone channers; extremely acid, pH 4.2, 1:1 water; abrupt irregular boundary.

Bw1—12 to 21 centimeters (5 to 8 inches); dark yellowish brown (10YR 4/6), broken face, extremely channery sandy loam; weak medium blocky and weak fine subangular blocky structure; very friable; 60 percent sandstone channers; extremely acid, pH 3.8, 1:1 water; clear irregular boundary.

Bw2—21 to 38 centimeters (8 to 15 inches); dark yellowish brown (10YR 4/6), broken face, very channery sandy loam; weak medium and weak fine subangular blocky structure; very friable; 50 percent sandstone channers; extremely acid, pH 3.9, 1:1 water; clear wavy boundary.

Bw3—38 to 55 centimeters (15 to 22 inches); light olive brown (2.5Y 5/6), broken face, very channery sandy loam; weak medium and weak fine subangular blocky structure; very friable; 50 percent sandstone channers; very strongly acid, pH 4.5, 1:1 water; gradual wavy boundary.

BC—55 to 68 centimeters (22 to 27 inches); light olive brown (2.5Y 5/6), broken face, extremely channery loam; weak fine subangular blocky structure; very friable; 60 percent sandstone channers; very strongly acid, pH 4.5, 1:1 water; abrupt smooth boundary.

R—68 centimeters (27 inches); indurated sandstone bedrock; very high excavation difficulty.

Range in Characteristics

Depth to bedrock: 51 to 102 centimeters (20 to 40 inches)

Rock fragments: 10 to 60 percent in individual horizons of the solum and 50 to 90 percent or more in the C horizon; amount increases as depth increases; flat, subangular or angular sandstone fragments that are 1 to 10 inches across

Soil reaction: Strongly acid to extremely acid throughout the profile

The A horizon has hue of 7.5YR to 10YR, value of 2 or 3, and chroma of 1 or 2. The Ap horizon (occurring in cultivated areas) has hue of 10YR, value of 4, and chroma of 2 to 4. The A horizon is loam, fine sandy loam, or sandy loam. Structure is weak very fine or fine granular.

The E horizon (if it occurs) has hue of 10YR, value of 5 or 6, and chroma of 1 to 4. Its texture and structure are similar to those of the A horizon.

Some pedons have a BA horizon. This horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is loam, sandy loam, or fine sandy loam.

The B horizon has hue of 7.5YR to 2.5Y and value and chroma of 4 to 8. It is loam, fine sandy loam, or sandy loam. The average clay content typically is between 6 to 15 percent but ranges to 18 percent in the particle-size control section. Structure is weak to moderate, fine or coarse subangular blocky.

The BC horizon (if it occurs) has hue of 7.5YR to 2.5Y, value of 5 to 8, and chroma of 4 to 8. Texture of the fine-earth fraction is sandy loam, fine sandy loam, or loam.

The C horizon (if it occurs) has hue of 7.5YR to 2.5Y, value of 5 or 6, and chroma of 4 to 8. Texture of the fine-earth fraction is sandy loam or loamy sand. Bedrock is gray to brown sandstone of varying hardness and is commonly fractured without displacement.

The Dekalb soils in Gauley River National Recreation Area are considered a taxadjunct to the Dekalb series because they typically have a semiactive cation-exchange activity class. This is due to the dominance of low-activity clay minerals in the subsoil. This difference, however, does not significantly affect the use and management of the soils.

Fenwick Series

The Fenwick series consists of moderately deep, moderately well drained soils that formed in residuum weathered from Pennsylvanian-age, acid sandstone or interbedded sandstone, siltstone, and shale (fig. 23). Fenwick soils are on broad mountain ridges. Slopes range from 3 to 15 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Figure 23.—A representative profile of the Fenwick series. Fenwick soils are 51 to 102 centimeters (20 to 40 inches) deep to impermeable bedrock. The bedrock "perches" a seasonal high water table which gives the soil a mottled appearance. In this photo, the mottling from the seasonal high water table begins at a depth of about 60 centimeters (24 inches) and highly weathered shale bedrock at a depth of 70 centimeters (28 inches). The photo is from Monongalia County, West Virginia. Scale is in centimeters.

Taxonomic Classification

Fine-loamy, mixed, semiactive, mesic Aquic Hapludults

Typical Pedon

Fenwick silt loam; Nicholas County, West Virginia; on a 7 percent slope in a forested area about 762 meters (2,500 feet) south-southeast of the intersection of County Route 22 and a National Park Service river access road, approximately 2.41

kilometers (1.5 miles) west of Arnett Chapel; at an elevation of 430 meters (1,411 feet); lat. 38 degrees 12 minutes 34 seconds N. and long. 81 degrees 00 minutes 49 seconds W.; NAD83; Ansted, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

Oi—0 to 2 centimeters (0 to 1 inch); slightly decomposed plant material; abrupt smooth boundary.

A—2 to 13 centimeters (1 to 5 inches); dark grayish brown (10YR 4/2), broken face, silt loam; weak fine and medium granular structure; very friable; many very fine to coarse roots; very strongly acid, pH 4.7 by Hellige-Truog; clear smooth boundary.

BA—13 to 20 centimeters (5 to 8 inches); yellowish brown (10YR 5/4), broken face, loam; weak medium subangular blocky structure; very friable; common very fine to medium roots; very strongly acid, pH 4.7 by Hellige-Truog; clear smooth boundary.

Bt1—20 to 56 centimeters (8 to 22 inches); yellowish brown (10YR 5/6), broken face, loam; moderate medium subangular blocky structure; friable; few very fine to medium roots; 10 percent distinct clay films on all faces of peds; very strongly acid, pH 4.5 by Hellige-Truog; clear wavy boundary.

Bt2—56 to 77 centimeters (22 to 30 inches); yellowish brown (10YR 5/4), broken face, loam; 25 percent clay; moderate medium subangular blocky structure; friable; 25 percent distinct clay films on all faces of peds; 10 percent fine distinct strong brown (7.5YR 5/8) masses of oxidized iron and 25 percent fine and medium distinct light brownish gray (10YR 6/2) iron depletions; very strongly acid, pH 4.5 by Hellige-Truog; clear wavy boundary.

Btg—77 to 93 centimeters (30 to 37 inches); light brownish gray (10YR 6/2), broken face, clay loam; 28 percent clay; moderate medium and coarse subangular blocky structure; firm; 30 percent distinct clay films on all faces of peds; 10 percent fine distinct yellowish brown (10YR 5/8) masses of oxidized iron and 10 percent fine and medium distinct yellowish brown (10YR 5/6) masses of oxidized iron; very strongly acid, pH 4.5 by Hellige-Truog; clear wavy boundary.

BC—93 to 99 centimeters (37 to 39 inches); strong brown (7.5YR 5/6), broken face, loam; 22 percent clay; weak medium subangular blocky structure; firm; 15 percent medium distinct pinkish gray (7.5YR 6/2) iron depletions and 25 percent medium and coarse distinct yellowish red (5YR 4/6) masses of oxidized iron; 10 percent flat moderately cemented siltstone gravel 2 to 20 millimeters in size; extremely acid, pH 4.0 by Hellige-Truog; clear wavy boundary.

Cg—99 to 112 centimeters (39 to 44 inches); light brownish gray (10YR 6/2) (60 percent), broken face, very channery loam; 20 percent clay; massive; firm; medium and coarse distinct yellowish brown (10YR 5/8) (10 percent) and distinct yellowish brown (10YR 5/6) (30 percent) masses of oxidized iron; 35 percent flat moderately cemented siltstone channers; extremely acid, pH 4.0 by Hellige-Truog; abrupt wavy boundary.

R—112 centimeters (44 inches); very strongly cemented sandstone bedrock; high excavation difficulty.

Range in Characteristics

Solum thickness: 50 to 101 centimeters (20 to 40 inches)

Depth to bedrock: 101 centimeters (40 inches)

Rock fragments: 0 to 15 percent, by volume, in the A, AB, BA, and Bt horizons and 5 to 35 percent in the BC and C horizons; commonly channers and flagstones

Soil reaction: Very strongly acid to neutral in the A horizon and very strongly acid or strongly acid in the Bt, BC, and C horizons

The A horizon and AB horizon (if it occurs) have hue of 7.5YR, 10YR, or 2.5Y and value and chroma of 2 to 4. Texture is silt loam or loam. Consistence is friable or very friable.

Some pedons have a BA horizon. This horizon is 0 to 6 inches thick. It has hue of 10YR, value of 3 to 5, and chroma of 3 or 4. Texture is silt loam or loam. Consistence is friable.

The Bt horizon has matrix hue of 7.5YR, 10YR, or 2.5Y, value of 5 or 6, and chroma of 4 to 6. Some pedons have a Btg horizon that contains red, brown, and gray mottles or redoximorphic features. Texture of the fine-earth fraction of the Bt horizon is loam, silt loam, or clay loam. Structure is weak or moderate, fine to coarse subangular blocky. Consistence is friable in the upper part of the horizon and friable to firm in the lower part.

Most pedons have a BC horizon. This horizon has colors and textures similar to those of the Bt horizon. Structure is weak subangular blocky or platy. Consistence is firm or very firm. Part of the BC horizon may have brittle characteristics.

Many pedons have a C or Cg horizon. This horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 7, and chroma of 2 to 6. Texture of the fine-earth fraction is sandy loam, loam, silt loam, or silty clay loam. Consistence is firm or very firm.

Highsplint Series

The Highsplint series consists of very deep, well drained soils that formed in stony loamy colluvium weathered from Pennsylvanian-age sandstone, siltstone, and shale (Kanawha Formation) (fig. 24). Highsplint soils are on mountain slopes. Slopes range from 15 to 80 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Loamy-skeletal, mixed, active, mesic Typic Dystrudepts

Typical Pedon

Highsplint channery loam; Raleigh County, West Virginia; on a 66 percent slope in a forested area on Spruce Mountain, about 2.53 kilometers (1.57 miles) west-southwest (on a bearing of 253 degrees) from the intersection of the West Virginia Turnpike and Clear Fork Road (County Route 1); at an elevation of 725 meters (2,380 feet); lat. 37 degrees 52 minutes 22.40 seconds N. and long. 81 degrees 17 minutes 40.85 seconds W.; NAD 83; Eccles, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

Oi—0 to 2 centimeters (0 to 0.5 inch); slightly decomposed plant material.

Oe—2 to 4 centimeters (0.5 inch to 1.5 inches); moderately decomposed plant material.

A1—4 to 10 centimeters (1.5 to 4 inches); very dark grayish brown (10YR 3/2) channery loam; moderate fine granular structure; very friable; common fine, common medium, common coarse, common very coarse, and common very fine roots throughout; 30 percent unspecified fragments; moderately acid, pH 6.0, 1:1 water; abrupt wavy boundary.

A2—10 to 22 centimeters (4 to 9 inches); dark brown (10YR 3/3) very channery loam; weak fine subangular blocky structure; very friable; common fine, common medium, common coarse, common very coarse, and common very fine roots throughout; 40 percent unspecified fragments; moderately acid, pH 5.7, 1:1 water; clear irregular boundary.

BA—22 to 31 centimeters (9 to 12 inches); dark yellowish brown (10YR 4/4) very channery loam; weak fine and weak medium subangular blocky structure; friable; common fine, common medium, and common coarse roots throughout; 40 percent unspecified fragments; strongly acid, pH 5.3, 1:1 water; clear wavy boundary.

Figure 24.—A representative profile of the Highsplint series. Highsplint soils formed in colluvium derived predominantly from materials weathered from the Kanawha Formation. The photo is from Fayette County, West Virginia. Scale is in centimeters.

Bw1—31 to 73 centimeters (12 to 29 inches); dark yellowish brown (10YR 4/6) very channery loam; weak medium subangular blocky structure; friable; common fine, common medium, and common coarse roots throughout; 45 percent unspecified fragments; strongly acid, pH 5.1, 1:1 water; gradual wavy boundary.

Bw2—73 to 120 centimeters (29 to 47 inches); strong brown (7.5YR 5/6) very channery loam; weak medium subangular blocky structure; friable; common medium and common coarse roots throughout; 50 percent unspecified fragments; very strongly acid, pH 4.9, 1:1 water; gradual wavy boundary.

BC—120 to 140 centimeters (47 to 55 inches); strong brown (7.5YR 5/6) extremely channery loam; weak fine and weak medium subangular blocky structure; friable;

common fine and common medium roots throughout; 60 percent unspecified fragments; strongly acid, pH 5.1, 1:1 water; gradual wavy boundary.

C—140 to 165 centimeters (55 to 65 inches); strong brown (7.5YR 5/6) extremely channery loam; massive; friable; common fine and common medium roots throughout; 80 percent unspecified fragments; strongly acid, pH 5.1, 1:1 water.

Range in Characteristics

Solum thickness: 102 to 152 centimeters (40 to 60 inches) or more
Depth to bedrock: More than 152 centimeters (60 inches)
Rock fragments: 35 to 90 percent of the soil, by volume; in a few pedons, to a depth of about 24 inches, horizons contain 15 to 35 percent rock fragments; mostly sandstone channers and flagstones
Soil reaction: Slightly acid to extremely acid in the surface layer and extremely acid to strongly acid in the solum and substratum

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. Some pedons have a thin A horizon with value of 2 and chroma of 1. Texture of the fine-earth fraction of the A horizon is sandy loam, fine sandy loam, silt loam, or loam. Transitional horizons dominated by A horizon material share these properties. In a few pedons, this horizon meets the depth requirements for a mollic or umbric epipedon but does not meet the dry color criteria.

The AB or BA horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. Texture of the fine-earth fraction is loam, silt loam, or silty clay loam.

The Bw horizon has hue of 7.5YR to 2.5Y, value of 3 to 6, and chroma of 4 to 8. Some pedons, below a depth of 40 inches, have lithochromic mottles or redoximorphic features in shades of brown, olive, or gray. Texture of the fine-earth fraction is loam, silt loam, clay loam, or silty clay loam. Silt content ranges from 35 to about 65 percent.

The BC horizon has colors and textures similar to those of the Bw horizon but commonly displays weak fragic properties believed to be the result of cementation from lateral water movement. This horizon also may have lithochromic mottles or redoximorphic features in shades of brown, olive, or gray below a depth of 40 inches.

The CB or C horizon (if it occurs) has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. Redoximorphic features in shades of brown, olive, or gray are common below a depth of 40 inches and generally increase in amount as depth increases. Texture of the fine-earth fraction is sandy loam, fine sandy loam, silt loam, silty clay loam, loam, or clay loam.

Laidig Series

The Laidig series consists of very deep, well drained soils that formed in colluvium derived from Pennsylvanian-age, acid sandstone or interbedded sandstone, siltstone, and shale (New River Formation) (fig. 25). Laidig soils are on mountain slopes, on footslopes, and in drainageways. Slopes range from 3 to 35 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Fine-loamy, siliceous, semiactive, mesic Typic Fragiudults

Typical Pedon

Laidig highly organic silt loam; Fayette County, West Virginia; on an 18 percent slope in a forested area, in an old road cut on the south side of the Miner’s Trail at the top of a National Park Service road near Cunard, about 692 meters (2,270 feet) southeast

Figure 25.—A representative profile of the Laidig series. Laidig soils have a dense layer in the subsoil called a fragipan (Btx horizon) which impedes root penetration and the movement of water downward through the soil profile. In this photo, the fragipan begins at a depth of about 122 centimeters (48 inches). The photo is from Fayette County, West Virginia. Scale is in centimeters.

of the town of Cunard; at an elevation of 486 meters (1,594 feet); lat. 38 degrees 00 minutes 02 seconds N. and long. 81 degrees 01 minute 58 seconds W.; NAD83; Fayetteville, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

Oi—0 to 2 centimeters (0 to 1 inch); slightly decomposed plant material; abrupt wavy boundary.

A—2 to 9 centimeters (1 to 4 inches); very dark grayish brown (10YR 3/2), crushed, highly organic silt loam; weak fine granular structure; very friable; common very fine to coarse roots throughout; 10 percent nonflat subrounded sandstone gravel; extremely acid, pH 4.2 by 1:1 water; clear wavy boundary

A/B—9 to 19 centimeters (4 to 7 inches); 40 percent yellowish brown (10YR 5/6), crushed, and 60 percent dark grayish brown (10YR 4/2), crushed, silt loam; weak medium and weak fine granular structure; very friable; common very fine to coarse roots throughout; 10 percent nonflat subrounded sandstone gravel; extremely acid, pH 4.3 by 1:1 water; gradual wavy boundary.

Bt1—19 to 35 centimeters (7 to 14 inches); yellowish brown (10YR 5/6), broken face, and dark yellowish brown (10YR 4/6), broken face, silt loam; weak medium and weak fine subangular blocky structure; friable; common fine and medium roots throughout; 5 percent patchy faint clay films on vertical faces of peds; 10 percent nonflat subrounded sandstone gravel; very strongly acid, pH 4.5 by 1:1 water; gradual wavy boundary.

Bt2—35 to 80 centimeters (14 to 31 inches); dark yellowish brown (10YR 4/6), broken face, and yellowish brown (10YR 5/6), broken face, silt loam; weak medium subangular blocky structure; friable; common fine and medium roots throughout; 25 percent discontinuous faint clay films on vertical faces of peds; 10 percent nonflat subrounded sandstone gravel; very strongly acid, pH 4.7 by 1:1 water; gradual wavy boundary.

Bt3—80 to 112 centimeters (31 to 44 inches); dark yellowish brown (10YR 4/6), broken face, and yellowish brown (10YR 5/6), broken face, gravelly silt loam; weak medium subangular blocky structure; friable; common fine and medium roots throughout; 15 percent discontinuous faint clay films on vertical faces of peds; 30 percent nonflat subrounded sandstone gravel; very strongly acid, pH 4.6 by 1:1 water; clear wavy boundary.

Bt4—112 to 122 centimeters (44 to 48 inches); yellowish brown (10YR 5/6), broken face, gravelly silt loam; weak medium platy structure; firm; common fine roots throughout; 10 percent patchy faint clay films on vertical faces of peds; 15 percent fine and medium light brownish gray (10YR 6/2) iron depletions on faces of peds and 15 percent fine and medium strong brown (7.5YR 4/6) masses of oxidized iron in matrix surrounding redoximorphic depletions; 30 percent nonflat subrounded sandstone gravel; very strongly acid, pH 4.6 by 1:1 water; gradual wavy boundary.

Btx—122 to 180 centimeters (48 to 71 inches); yellowish brown (10YR 5/6), broken face, very gravelly loam; weak very coarse prismatic structure; very firm; few fine roots on vertical faces of peds; 1 percent patchy faint clay films on vertical faces of peds; 1 percent fine and medium light brownish gray (10YR 6/2) iron depletions on vertical faces of peds and 1 percent fine and medium strong brown (7.5YR 4/6) masses of oxidized iron infused into matrix along faces of peds; 40 percent nonflat subrounded sandstone gravel; very strongly acid, pH 4.8 by 1:1 water.

Range in Characteristics

Solum thickness: 127 to 203 centimeters (50 to 80 inches)
Depth to bedrock: more than 152 centimeters (60 inches)
Depth to the fragipan: 76 to 127 centimeters (30 to 50 inches) (fig. 26)

Figure 26.—Gray zones of iron depletion and reddish zones of oxidized iron concentrations (redoximorphic features) occur along structural faces in the fragipan layer of Laidig soils. These features are indicative of how slowly water passes through this layer.

Content of rock fragments: Average of less than 35 percent in the particle-size control section; 5 to 50 percent in individual subhorizons of the A, E, BE, BA, and Bt horizons, 15 to 70 percent in individual subhorizons of the Btx horizon, and 20 to 70 percent in the C horizon
Soil reaction: Extremely acid to strongly acid throughout the profile in unlimed areas

The A horizon has hue of 10YR, value of 2 to 5, and chroma of 1 to 4. The Ap horizon (if it occurs) has chroma of 2 to 8. Texture of the fine-earth fraction of the A horizon is loam, sandy loam, fine sandy loam, or silt loam.

The E horizon (if it occurs) has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 6. Texture of the fine-earth fraction is loam, fine sandy loam, sandy loam, and, less commonly, silt loam.

The BE horizon (if it occurs) has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 8. Texture of the fine-earth fraction is loam, fine sandy loam, sandy loam, or silt loam.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 8. Subhorizons immediately above the Btx horizon may have hue of 5YR. The Bt horizon may have redoximorphic features at a depth of 30 inches or more. Texture of the fine-earth fraction is loam, sandy clay loam, clay loam, fine sandy loam, sandy loam, or silt loam. The horizon has weak or moderate, fine or medium subangular blocky structure.

The Btx horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 3 to 8. It has high- and low-chroma redoximorphic features. Texture of the fine-earth fraction is fine sandy loam, sandy loam, loam, sandy clay loam, clay loam, or silt loam. The horizon has weak very coarse prismatic structure parting to platy or subangular blocky.

The C horizon (if it occurs) has hue of 5YR to 10YR, value of 5 or 6, and chroma of 3 to 8. It has high- and low-chroma redoximorphic features. Texture of the fine-earth fraction is fine sandy loam, sandy loam, loam, sandy clay loam, clay loam, or silt loam.

The Laidig soils in Gauley River National Scenic River are considered a taxadjunct to the Laidig series because they typically have a semiactive cation-exchange activity class. This is due to the dominance of low-activity clay minerals in the subsoil. This difference, however, does not significantly affect the use and management of the soils.

Layland Series

The Layland series consists of very deep, well drained soils that formed in colluvium derived from Pennsylvanian-age, acid sandstone and shale (New River Formation) (fig. 27). Layland soils are on mountain slopes and footslopes. Slopes range from 15 to 70 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts

Typical Pedon

Layland cobbly silt loam in an area of Layland-Rock outcrop complex; Nicholas County, West Virginia; on a 49 percent slope in a forested area on the Nicholas County side of the Gauley River, about 1,207 meters (3,960 feet) east of the confluence of Collison Creek and the Gauley River; at an elevation of 424 meters (1,391 feet); lat. 38 degrees 12 minutes 13 seconds N. and long. 80 degrees 54 minutes 49 seconds W.; NAD83; Summersville Dam, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

A1—0 to 5 centimeters (0 to 2 inches); very dark grayish brown (10YR 3/2), broken face, cobbly silt loam; moderate fine and medium granular structure; very friable; common fine and medium, few coarse, and many very fine roots; 10 percent nonflat subangular sandstone gravel and 20 percent nonflat subangular sandstone cobbles; very strongly acid, pH 4.8 by Hellige-Truog; abrupt wavy boundary.

A2—5 to 20 centimeters (2 to 8 inches); dark brown (10YR 3/3), broken face, very stony silt loam; moderate fine and medium granular structure; very friable; common coarse, few very coarse, and common very fine to medium roots; 15 percent flat subangular sandstone channers and 30 percent nonflat subangular sandstone stones; very strongly acid, pH 4.8 by Hellige-Truog; clear wavy boundary.

BA—20 to 40 centimeters (8 to 16 inches); brown (10YR 4/3), broken face, stony silt loam; weak medium granular structure; very friable; common fine to coarse and few very fine roots; 15 percent nonflat subangular sandstone gravel and 25 percent nonflat subangular sandstone stones; very strongly acid, pH 4.7 by Hellige-Truog; clear wavy boundary.

Bw1—40 to 50 centimeters (16 to 20 inches); dark yellowish brown (10YR 4/6), broken face, very cobbly silt loam; 24 percent clay; moderate medium subangular blocky structure; friable; few very fine and fine and common medium roots; 10 percent flat subangular sandstone channers, 10 percent nonflat subangular sandstone stones, and 20 percent nonflat subangular sandstone cobbles; very strongly acid, pH 4.8 by Hellige-Truog; gradual wavy boundary.

Bw2—50 to 111 centimeters (20 to 44 inches); yellowish brown (10YR 5/4), broken face, very stony loam; 26 percent clay; moderate fine and medium subangular blocky structure; friable; few fine roots; 10 percent flat subangular sandstone

Figure 27.—A representative profile of the Layland series. Disoriented rock fragments in the soil profile are an indication that the soil formed in colluvium (i.e., materials that have moved downslope). Layland soils formed in colluvium derived predominantly from materials weathered from the New River Formation. The photo is from the Gauley River gorge. Scale is in inches.

stones, 15 percent flat subangular sandstone channers, and 20 percent flat subangular sandstone flagstones; very strongly acid, pH 4.9 by Hellige-Truog; clear wavy boundary.

Bw3—111 to 142 centimeters (44 to 56 inches); yellowish brown (10YR 5/4), broken face, very channery clay loam; 28 percent clay; weak medium subangular blocky structure; friable; 5 percent flat subangular sandstone stones, 10 percent flat subangular sandstone flagstones, and 20 percent flat subangular sandstone channers; very strongly acid, pH 4.8 by Hellige-Truog; gradual wavy boundary.

BC—142 to 200 centimeters (56 to 79 inches); yellowish brown (10YR 5/4), broken face, very stony loam; 24 percent clay; weak coarse subangular blocky structure; firm; 2 percent fine distinct light brownish gray (10YR 6/2) and 8 percent fine faint brown (10YR 5/3) iron depletions infused into matrix along faces of peds; 12 percent medium faint dark yellowish brown (10YR 4/6) masses of oxidized iron in matrix surrounding redoximorphic depletions; 5 percent flat subangular sandstone flagstones, 15 percent flat subangular sandstone stones, and 20 percent flat subangular sandstone channers; very strongly acid, pH 4.8 by Hellige-Truog.

Range in Characteristics

Solum thickness: 72 to 200 centimeters (30 to 79 inches)
Depth to bedrock: More than 152 centimeters (60 inches)
Rock fragments: 5 to 60 percent, by volume, in the solum and 30 to 90 percent in the BC and C horizons; dominantly sandstone in the upper part of the profile; fragments of siltstone and shale commonly increase in volume as depth increases
Soil reaction: Very strongly acid or extremely acid

The A horizon has hue of 7.5YR to 2.5Y, value of 2 to 5, and chroma of 1 to 4. Texture of the mineral fine-earth fraction is loam or silt loam.

The BA horizon (or similar transitional horizon) has hue of 7.5YR to 2.5Y, value of 3 to 6 (6 or more dry), and chroma of 3 to 6. Texture of the fine-earth fraction is loam or silt loam.

The E horizon (or transitional eluvial horizon), if it occurs, has hue of 10YR to 2.5Y, value of 4 to 6 (6 or more dry), and chroma of 2 to 6. Texture of the fine-earth fraction is loam or silt loam

The Bw horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. Texture of the fine-earth fraction is loam, silt loam, or clay loam.

The BC or 2BC horizon has hue of 7.5YR to 2.5Y and value and chroma of 4 to 8. Texture of the fine-earth fraction is loam, silt loam, clay loam, or silty clay loam.

The C or 2C horizon (if it occurs) has hue of 7.5YR to 2.5 and value and chroma of 4 to 8. Texture of the fine-earth fraction is loam, silt loam, clay loam, or silty clay loam.

Lithic Udorthents

Lithic Udorthents consist of shallow, somewhat excessively drained soils. They formed in areas that have been disturbed by excavation, grading, cutting, filling, or a combination of these activities. The parent material is highly variable but generally consists of a mixture of native soil material over sandstone or shale primarily from Pennsylvanian- or Mississippian-age sedimentary rock. Slopes range from 0 to 100 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Lithic Udorthents

Typical Pedon

Lithic Udorthents; Nicholas County, West Virginia; on a 1 percent slope in an idle area within the spillway area for the Summersville Dam, about 1,127 meters (3,696 feet) southwest of the entrance to a roadside park and 322 meters (1,056 feet) southeast of the entrance to the Battle Run Campground; at an elevation of 513 meters (1,683 feet); lat. 38 degrees 12 minutes 56 seconds N. and long. 80 degrees 54 minutes 19 seconds W.; NAD83; Summersville Dam, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

A—0 to 10 centimeters (0 to 4 inches); dark brown (10YR 3/3), crushed, very gravelly loam; weak medium and weak fine granular structure; friable; 1 percent nonflat subangular very strongly cemented sandstone stones and 40 percent nonflat angular strongly cemented sandstone gravel; very strongly acid, pH 4.5 by Hellige-Truog; gradual wavy boundary.

C—10 to 22 centimeters (4 to 9 inches); brownish yellow (10YR 6/6), crushed, extremely gravelly sandy loam; massive; friable; 65 percent nonflat angular strongly cemented sandstone gravel; extremely acid, pH 4.4 by Hellige-Truog; abrupt smooth boundary.

R—22 to 23 centimeters (9 inches); indurated sandstone bedrock; very high excavation difficulty.

Range in Characteristics

Solum thickness: Less than 51 centimeters (20 inches)
Depth to bedrock: Less than 51 centimeters (20 inches)
Content of rock fragments: Variable, commonly more than 35 percent throughout the profile
Soil reaction: Variable, depending on the nature of the parent lithology

Nallen Series

The Nallen series consists of moderately deep, well drained soils that formed in residuum weathered from Pennsylvanian-age sandstone (fig. 28). Nallen soils are on mountain ridges. Slopes range from 3 to 25 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Coarse-loamy, siliceous, semiactive, mesic Typic Hapludults

Typical Pedon

Nallen loam; Fayette County, West Virginia; on a 9 percent slope in a forested area on a ridge near the edge of the Meadow River gorge, about 610 meters (2,000 feet) southeast of the U.S. Route 19 bridge over the Meadow River; at an elevation of 558 meters (1,831 feet); lat. 38 degrees 08 minutes 45 seconds N. and long. 80 degrees 55 minutes 31 seconds W.; NAD83; Summersville Dam, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

Oi—0 to 2 centimeters (0 to 1 inch); slightly decomposed plant material; abrupt wavy boundary.

A—2 to 15 centimeters (1 to 6 inches); very dark grayish brown (10YR 3/2), broken face, loam; 8 percent clay; moderate medium granular structure; very friable; 5 percent nonflat subangular moderately cemented sandstone gravel and 5 percent nonflat subangular very strongly cemented sandstone gravel; very strongly acid, pH 4.5 by Hellige-Truog; abrupt smooth boundary.

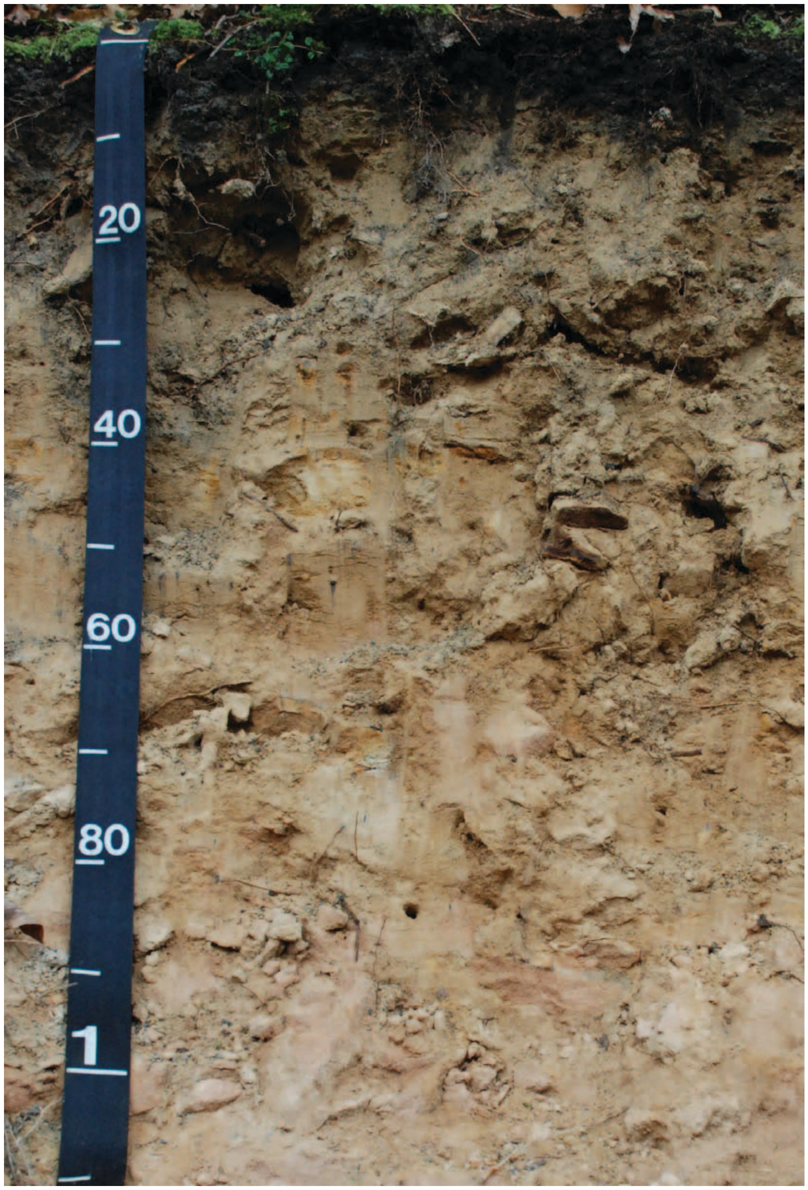

Figure 28.—A representative profile of the Nallen series. Nallen soils are 51 to 102 centimeters (20 to 40 inches) deep to sandstone bedrock. In this photo, highly weathered sandstone bedrock occurs at a depth of approximately 90 centimeters (35 inches). The photo is from the New River Gorge National River park. Scale is in centimeters.

B/A—15 to 23 centimeters (6 to 9 inches); 40 percent dark brown (10YR 3/3) and 60 percent yellowish brown (10YR 5/4), broken face, gravelly loam; 10 percent clay; weak medium subangular blocky structure; friable; 10 percent nonflat subangular moderately cemented sandstone gravel and 10 percent nonflat subangular very strongly cemented sandstone gravel; very strongly acid, pH 4.5 by Hellige-Truog; clear wavy boundary.

Bt—23 to 53 centimeters (9 to 21 inches); yellowish brown (10YR 5/6), broken face, gravelly loam; 16 percent clay; moderate medium subangular blocky structure; friable; 10 percent patchy faint clay films on surfaces along pores; 10 percent nonflat subangular very strongly cemented sandstone gravel and 10 percent

nonflat subangular moderately cemented sandstone gravel; very strongly acid, pH 4.5 by Hellige-Truog; clear wavy boundary.

BC—53 to 67 centimeters (21 to 26 inches); yellowish brown (10YR 5/6), broken face, gravelly loam; 14 percent clay; weak coarse subangular blocky structure; friable; 10 percent nonflat subangular very strongly cemented sandstone gravel and 15 percent nonflat subangular moderately cemented sandstone gravel; extremely acid, pH 4.4 by Hellige-Truog; abrupt wavy boundary.

R—67 to 77 centimeters (26 to 30 inches); indurated sandstone bedrock; very high excavation difficulty.

Range in Characteristics

Solum thickness: 23 to 102 centimeters (9 to 40 inches)
Depth to bedrock: 51 to 102 centimeters (20 to 40 inches)
Content of rock fragments: 0 to 15 percent in the upper part of the solum and 5 to 50 percent in the BC and C horizons
Soil reaction: Very strongly acid to extremely acid throughout the profile, except in areas that have been limed or affected by burning

The A or Ap horizon has hue of 10YR or 2.5Y, value of 2 to 5, and chroma of 1 to 4. Texture of the fine-earth fraction is silt loam, loam, fine sandy loam, or sandy loam.

The BA horizon (or similar transitional horizon) has hue of 7.5YR to 2.5Y, value of 3 to 6 (6 or more dry), and chroma of 3 to 6. Texture of the fine-earth fraction is silt loam, loam, fine sandy loam, or sandy loam.

The E horizon (or transitional eluvial horizon), if it occurs, has hue of 10YR to 2.5Y, value of 4 to 6 (6 or more dry), and chroma of 2 to 6. Texture of the fine-earth fraction is silt loam, loam, fine sandy loam, or sandy loam

The Bt horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 8. Texture of the fine-earth fraction is loam, fine sandy loam, or sandy loam.

The BC or CB horizon has hue of 7.5YR to 2.5Y and value and chroma of 4 to 8. Texture of the fine-earth fraction is loam, fine sandy loam, or sandy loam.

The C horizon (if it occurs) has hue of 7.5YR to 2.5Y and value and chroma of 4 to 8. Texture of the fine-earth fraction is loam, fine sandy loam, sandy loam, or loamy sand. Lithochromic features in shades of yellow and reddish brown may occur.

Pope Series

The Pope series consists of very deep, well drained soils that formed in acid alluvium derived mainly from Pennsylvanian-age, acid sandstone, siltstone, and shale (fig. 29). Pope soils are on flood plains in river valleys. Slopes range from 0 to 3 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Coarse-loamy, mixed, active, mesic Fluventic Dystrudepts

Typical Pedon

Pope sandy loam; Nicholas County, West Virginia; on a 3 percent slope in a forested area approximately 198 meters (650 feet) west of the boat launch at the Masons Branch river take out on the Gauley River; at an elevation of 317 meters (1,040 feet); lat. 38 degrees 13 minutes 23 seconds N. and long. 80 degrees 59 minutes 32 seconds W.; NAD83; Summersville Dam, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

Oi—0 to 5 centimeters (0 to 2 inches); slightly decomposed plant material; abrupt broken boundary.

Figure 29.—A representative profile of the Pope series, located in a cultivated field. This young alluvial soil does not have distinctive genetic horizons in the subsoil. The bright yellowish brown colors indicate a well drained soil. The photo is from Lincoln County, West Virginia. Scale is in centimeters.

Oe—5 to 8 centimeters (2 to 3 inches); moderately decomposed plant material; abrupt broken boundary.

A—8 to 18 centimeters (3 to 7 inches); dark brown (10YR 3/3), broken face, sandy loam; weak medium granular structure; 5 percent well rounded indurated sandstone gravel; very strongly acid, pH 4.6 by Hellige-Truog; abrupt wavy boundary.

Bw1—18 to 56 centimeters (7 to 22 inches); yellowish brown (10YR 5/6), broken face, sandy loam; weak medium subangular blocky structure; 1 percent subrounded very weakly cemented charcoal fragments 2 to 5 millimeters in size, 2 percent well rounded indurated sandstone cobbles, and 8 percent well rounded indurated

sandstone gravel; very strongly acid, pH 4.6 by Hellige-Truog; clear wavy boundary.

Bw2—56 to 81 centimeters (22 to 32 inches); strong brown (7.5YR 5/6), broken face, gravelly sandy loam; weak coarse subangular blocky structure; 5 percent well rounded indurated sandstone cobbles and 10 percent well rounded indurated sandstone gravel; very strongly acid, pH 4.5 by Hellige-Truog; gradual wavy boundary.

C—81 to 200 centimeters (32 to 79 inches); yellowish brown (10YR 5/6), broken face, extremely cobbly loamy sand; single grain; 10 percent rounded indurated sandstone stones, 25 percent well rounded indurated sandstone cobbles, and 30 percent well rounded indurated sandstone gravel; very strongly acid, pH 4.5 by Hellige-Truog.

Range in Characteristics

Solum thickness: 72 to 200 centimeters (30 to 60 inches)
Depth to bedrock: More than 152 centimeters (60 inches)
Rock fragments: 0 to 30 percent, by volume, in the solum and 0 to 75 percent in the substratum; gravel, channers, and cobbles
Soil reaction: Very strongly acid or extremely acid

The Ap or A horizon has hue of 10YR and value and chroma of 3 to 6. If value is 3, dry color is 6 or more. Texture of the fine-earth fraction is fine sandy loam, sandy loam, loam, or silt loam.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. In some pedons, it has iron depletions with chroma of 2 or less below a depth of 40 inches. Texture of the fine-earth fraction is sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam.

The C or 2C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. In some pedons, it has iron depletions with chroma of 2 or less. Texture of the fine-earth fraction is loamy sand, loamy fine sand, fine sandy loam, sandy loam, loam, or sandy clay loam, or the horizon has stratified layers of these textures. Some pedons have stratified sand layers below a depth of 40 inches.

Sharondale Series

The Sharondale series consists of very deep, well drained soils that formed in loamy colluvium derived from a mixture of Pennsylvanian-age sandstone, siltstone, and shale and thin beds of limestone (Kanawha Formation). Sharondale soils are in north- or east-facing mountain coves. Slopes range from 35 to 80 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Loamy-skeletal, mixed, active, mesic Typic Hapludolls

Typical Pedon

Sharondale silt loam; Fayette County, West Virginia; on a north-facing, 51 percent slope in a forested area of a mountain cove, about 1,883 meters (6,178 feet) south-southwest of the confluence of Peters Creek and the Gauley River and 2,044 meters (6,706 feet) northwest of Mt. Eary Church; at an elevation of 495 meters (1,624 feet); lat. 38 degrees 12 minutes 29 seconds N. and long. 81 degrees 02 minutes 59 seconds W.; NAD83; Ansted, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

Oi—0 to 4 centimeters (0 to 2 inches); slightly decomposed plant material; abrupt wavy boundary.

A1—4 to 21 centimeters (2 to 8 inches); dark brown (10YR 3/3), crushed and dry, silt loam, very dark brown (10YR 2/2), crushed and moist; 23 percent clay; strong fine granular structure; very friable; common fine and very fine and few medium roots throughout; 4 percent flat subangular moderately cemented shale channers and 6 percent nonflat subrounded strongly cemented sandstone gravel; neutral, pH 6.8 by Hellige-Truog; abrupt wavy boundary.

A2—21 to 38 centimeters (8 to 15 inches); brown (10YR 5/3), crushed and dry, and dark brown (10YR 3/3), crushed and moist, gravelly silt loam; 21 percent clay; moderate fine and medium granular structure; very friable; common fine and very fine and few medium roots throughout; 6 percent flat subangular moderately cemented shale channers and 9 percent nonflat subrounded strongly cemented sandstone gravel; neutral, pH 6.7 by Hellige-Truog; clear wavy boundary.

AB—38 to 65 centimeters (15 to 26 inches); dark yellowish brown (10YR 3/4), broken face, gravelly silt loam; 23 percent clay; weak medium subangular blocky structure parting to moderate medium granular; very friable; few very fine to very coarse roots throughout; 10 percent flat subangular moderately cemented shale channers and 15 percent nonflat subrounded strongly cemented sandstone gravel; slightly acid, pH 6.5 by Hellige-Truog; gradual wavy boundary.

Bw1—65 to 91 centimeters (26 to 36 inches); brown (10YR 4/3), broken face, very gravelly silt loam; 24 percent clay; weak medium subangular blocky structure; friable; few very fine to very coarse roots throughout; 20 percent flat subangular moderately cemented shale channers and 25 percent nonflat subangular strongly cemented sandstone gravel; slightly acid, pH 6.5 by Hellige-Truog; clear wavy boundary.

Bw2—91 to 130 centimeters (36 to 51 inches); strong brown (10YR 4/6) very flaggy silt loam; 24 percent clay; moderate medium subangular blocky and moderate medium prismatic structure; friable; common fine and medium roots throughout; 20 percent flat subangular moderately cemented shale channers and 30 percent flat subangular strongly cemented sandstone flagstones; moderately acid, pH 5.8 by Hellige-Truog; gradual wavy boundary.

BC—130 to 190 centimeters (51 to 75 inches); strong brown (7.5YR 4/6) extremely channery silt loam; 26 percent clay; weak fine and weak medium subangular blocky structure; friable; common fine roots throughout; 35 percent flat subangular moderately cemented shale channers and 25 percent flat subangular strongly cemented sandstone channers; moderately acid, pH 5.8 by Hellige-Truog; abrupt smooth boundary.

2Cr—190 to 200 centimeters (75 to 79 inches); weathered shale bedrock; moderate excavation difficulty.

Range in Characteristics

Solum thickness: 102 to 203 centimeters (40 to 80 inches)

Depth to bedrock: More than 152 centimeters (60 inches)

Rock fragments: 10 to 85 percent in individual horizons; average of 35 percent or more in the particle-size control section; flat fragments are mostly 2 millimeters to 38 centimeters (15 inches) in length

Soil reaction: Strongly acid to neutral throughout the profile

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3 (3 to 5 dry), and chroma of 1 to 3 (3 to 5 dry). Texture of the fine-earth fraction is silt loam, loam, fine sandy loam, or sandy loam.

The B horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 3 to 6. Texture of the fine-earth fraction is silt loam, loam, fine sandy loam, or sandy loam. In

some pedons, this horizon displays lithochromic mottles in shades of brown, yellow, red, or gray. In some pedons, it has very few or few thin discontinuous silt coatings or clay films on faces of peds and on rock surfaces below a depth of about 30 inches.

The C horizon (if it occurs) has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 3 to 8. Texture of the fine-earth fraction is silt loam, loam, silty clay loam, clay loam, fine sandy loam, or sandy loam. In some pedons, this horizon has lithochromic mottles and discontinuous silt coatings or clay films similar to those of the B horizon. Bedrock is hard sandstone or siltstone and, less commonly, soft shale.

Typic Haplorthods

Typic Haplorthods consist of very deep, well drained soils that formed in acid alluvium derived from Pennsylvanian-age sandstone, siltstone, and shale. These soils are on low terraces of flood plains in river valleys. Slopes range from 0 to 8 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Loamy-skeletal, mixed, active, mesic Typic Haplorthods

Typical Pedon

Typic Haplorthods highly organic sandy loam; Fayette County, West Virginia; on a 5 percent slope on an forested island in the Meadow River about 3.7 kilometers (2.3 miles) downstream from the U.S. Route 19 bridge; at an elevation of 415 meters (1,360 feet); lat. 38 degrees 10 minutes 21 seconds N. and long. 80 degrees 56 minutes 49 seconds W.; NAD83; Summersville Dam, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

Oi—0 to 2 centimeters (0 to 1 inch); slightly decomposed plant material; abrupt wavy boundary.

Oe—2 to 4 centimeters (1 to 2 inches); moderately decomposed plant material; many very fine to medium roots throughout; abrupt wavy boundary.

A—4 to 13 centimeters (2 to 5 inches); black (7.5YR 2/1), rubbed, highly organic sandy loam; moderate fine granular structure; very friable; many very fine to medium roots; extremely acid, pH 4.3 by Hellige-Truog; abrupt smooth boundary.

E—13 to 33 centimeters (5 to 13 inches); light gray (10YR 7/2), broken face, loamy sand; single grain; very friable; common very fine to medium roots throughout; extremely acid, pH 4.1 by Hellige-Truog; abrupt smooth boundary.

Bhs—33 to 43 centimeters (13 to 17 inches); black (5YR 2/1), broken face, sandy loam; weak medium subangular blocky structure; friable; few very fine and fine roots throughout; extremely acid, pH 4.3 by Hellige-Truog; abrupt wavy boundary.

Bs—43 to 92 centimeters (17 to 36 inches); strong brown (7.5YR 5/8), broken face, extremely stony sandy loam; weak medium subangular blocky structure; very friable; few very fine and fine roots; 15 percent nonflat rounded indurated sandstone gravel, 25 percent nonflat rounded indurated sandstone cobbles, and 30 percent nonflat subrounded indurated sandstone stones; extremely acid, pH 4.3 by Hellige-Truog; gradual wavy boundary.

C—92 to 165 centimeters (36 to 65 inches); dark yellowish brown (10YR 4/6), broken face, extremely stony loamy sand; single grain; very friable; 15 percent nonflat rounded indurated sandstone gravel, 30 percent nonflat rounded indurated sandstone cobbles, and 35 percent nonflat rounded indurated sandstone stones; extremely acid, pH 4.4 by Hellige-Truog.

Range in Characteristics

Depth to bedrock: More than 165 centimeters (60 inches)
Rock fragments: 10 to 60 percent in individual horizons of the solum and 50 to 90 percent or more in the C horizon; amount increases as depth increases; rounded fragments of dominantly sandstone; mixture of gravel, cobbles, stones, and boulders
Soil reaction: Very strongly acid or extremely acid throughout the profile

Udorthents

Udorthents mainly consist of well drained, deep or very deep soils. These soils formed in a mixture of native soil and geologic materials that have been drastically disturbed by excavation, grading, cutting, filling, or a combination of these activities. The parent material is highly variable but generally consists of a mixture of native soils and excavated bedrock from local sources. Slopes range from 0 to 55 percent. The mean annual precipitation is about 1,207 millimeters (47.5 inches), and the mean annual air temperature is about 10.6 degrees C (51 degrees F).

Taxonomic Classification

Udorthents

Typical Pedon

Udorthents in an area of Udorthents-Urban land complex, highways; Summers County, West Virginia; on a 53 percent slope above Route 20 and adjacent to the I-64 overpass, about 229 meters (750 feet) southeast of Sandstone High School; the site is located within the lower clover leaf formed by the highway off ramp; at an elevation of 410 meters (1,345 feet); lat. 37 degrees 46 minutes 50 seconds N. and long. 80 degrees 53 minutes 39 seconds W.; NAD83; Meadow Creek, West Virginia USGS topographic quadrangle. (When described, the soil was moist throughout.)

A—0 to 4 centimeters (0 to 2 inches); brown (7.5YR 4/3), broken face, very channery silt loam; 23 percent clay; weak very coarse subangular blocky structure parting to moderate fine subangular blocky; friable; common fine and medium and many very fine roots throughout; common fine tubular pores; 1 percent flat subangular moderately cemented sandstone stones, 5 percent flat subangular weakly cemented sandstone channers, and 40 percent nonflat subangular very weakly cemented siltstone gravel; strongly acid, pH 5.5 by Hellige-Truog; clear wavy boundary.
AC—4 to 27 centimeters (2 to 11 inches); brown (7.5YR 4/4), broken face, very channery silt loam; 25 percent clay; weak coarse subangular blocky structure parting to weak fine subangular blocky; friable; common very fine and fine roots throughout and common medium roots around fragments; common fine tubular and common medium irregular pores; 5 percent nonflat subangular very weakly cemented siltstone gravel, 15 percent nonflat subrounded weakly cemented sandstone gravel, and 20 percent flat subangular weakly cemented siltstone channers; very strongly acid, pH 5.0 by Hellige-Truog; gradual wavy boundary.
C—27 to 165 centimeters (11 to 65 inches); reddish brown (5YR 4/4), broken face, extremely gravelly silt loam; 18 percent clay; massive; friable; common very fine and fine roots throughout and common medium and coarse roots around fragments; common fine tubular and many very coarse irregular pores; 10 percent flat subangular weakly cemented siltstone stones, 10 percent nonflat subangular very weakly cemented siltstone gravel, 20 percent flat subangular weakly cemented siltstone channers, and 40 percent nonflat subrounded weakly cemented sandstone gravel; very strongly acid, pH 5.0 by Hellige-Truog.

Range in Characteristics

Thickness of solum (A and AC horizons): Variable; commonly less than 38 centimeters (15 inches)
Depth to bedrock: Variable; commonly more than 102 centimeters (40 inches)
Rock fragment content: Variable; commonly more than 35 percent throughout the profile
Soil reaction: Variable, depending on the nature of the geologic parent material

Formation of the Soils

This section discusses the factors of soil formation and relates them to the soils in Gauley River National Recreation Area.

Factors of Soil Formation

Soil covers the surface of the earth as a three-dimensional body with varying depths and is made up of different proportions of organic and mineral material, pore space with gases, and water. Soils differ in their appearance, productivity, and management requirements due to their chemical and physical properties. The characteristics and properties of soils are determined by physical and chemical processes that result from the interaction of five soil-forming factors. These factors of soil formation are interdependent, and few generalizations can be made regarding any one factor unless the effects of the other factors are known. The term pedogenesis is often used to connote the process of soil formation.

The study of soil science, known as pedology, began in the 19th century as scientists began to consider soils as natural bodies, independent of their underlying geology. This concept developed into a more quantitative principle in which the formation of soil and its properties are the result of interrelated factors. The soil-forming factors are parent material, climate, plant and animal organisms, topography, and time (Jenny, 1941). Parent material is the source material in which soils formed. Soils are influenced by the texture and structure of the parent material and its mineralogical and chemical composition. Climate is predominantly the temperature and kind and amount of precipitation. Organisms are the plants and other organisms living in and on the soil, including humans. Time refers to how long the soil-forming factors have been operating. Relief or topography is the shape and elevation of the landscape. It affects internal and external soil properties, such as soil drainage, aeration, susceptibility to erosion, and the soil's exposure to the sun and wind. The examination of the relationships and influences of each of these factors within a survey area can help us to better understand the physical and chemical characteristics of soils.

The influence of any one of the soil-forming factors varies among all parks and within localities of a particular park. Soils may differ significantly from place to place in a park and within very short distances. In some cases, parks may have vast stretches of the same type of soil because of uniform soil-forming factors.

Parent Material and Time

Soils are described as having formed in various types of parent material. The properties of the parent material strongly influence the time required for soil formation and the nature of the soils produced. There are four general types of parent material in Gauley River National Recreation Area: alluvium, colluvium, residuum, and human-transported materials (HTM).

Alluvium consists of the detrital materials deposited by streams and includes various combinations of sand, silt, clay, and rock fragments. Colluvium consists of soil

materials and rock fragments that accumulate at the base of slopes and in concave coves by gravitational action. Residuum consists of soil materials accumulated by the disintegration of consolidated bedrock in place. HTM is unsorted, unconsolidated earthy materials deposited by directed human activity and includes the earthy materials used to construct road beds, railroad beds, dam spillways, etc. These four types of parent materials have formed the 17 major soil types which have been correlated and classified within the boundaries of the park. Fourteen soil types were correlated and classified to the soil series level, and three soil types were classified at the higher levels of Soil Taxonomy.

The properties of soils are greatly influenced by the properties of their parent bedrocks. Two geologic formations have weathered to provide the local alluvium, residuum, and colluvium in the park. The parent bedrocks are members of the Pennsylvania-age Kanawha and New River Formations of the Pottsville Group (fig. 30). The strata of the Kanawha Formation are about 50 percent sandstone, but this formation also contains significant amounts of shale, siltstone, and coal and a few thin beds of limestone. The New River Formation is dominated by massive beds of acid sandstone, but it also contains gray and dark gray siltstone, shale, and coal (West Virginia Geological Survey, 1919).

Sampling and analysis of the soils on these geologic formations has determined that there are differences in soil chemistry and mineralogy which affect soil fertility. On the young, very steep upland landforms in the park (backslopes), the soils that formed in materials weathered from the New River Formation are very acidic and have low natural fertility. The clay minerals of these soils have been intensely weathered, which hinders the soil's ability to retain plant nutrients. The sand and silt fraction of many of these soils is dominantly quartz (siliceous mineralogy), which is highly resistant to weathering and inert and adds nothing to the soil's nutrient reserves. In comparison, on these same landforms, the soils that formed from materials weathered from the Kanawha Formation are slightly more fertile. They are less acidic, have an array of clay minerals that are better able to retain plant nutrients, and contain more weatherable minerals in the sand and silt fractions of the fine-earth. These differences are not as pronounced on older, less sloping landforms (summits and shoulder slopes). In these areas, the soils have undergone intense weathering which has mitigated the effects of the geologic parent materials on their chemical properties and clay mineralogy.

Time refers to a measured period in which soil-forming processes have been at work. Generally, the longer the processes have been at work, the older the soil and the more well developed the soil profile. In turn, a well developed soil profile is often a reflection of an old and stable landscape. Mature soils exhibit well developed structure, strong colors, and distinct genetic horizons (fig. 31). In the park, these soil profile features are mainly the result of the addition of silicate clay minerals and oxides of iron and aluminum to the subsoil by translocation, mainly downward, through the soil profile. Young soils lack distinct genetic horizons, strong color, and/or structure because these features have not had time to form (fig. 32). This is often a reflection of a dynamic landscape.

Soils That Formed in Alluvium

Because the Gauley and Meadow Rivers and their tributaries (fig. 33) are swift and drop in elevation so rapidly, their floodwaters have not deposited great amounts of alluvium in the park. Much of the sediment load in these rivers is carried downstream and out of the park. Alluvial soils on the active flood plains of the park's rivers and tributaries account for only 1 percent of the park's acreage. An interesting area of alluvium known as Koontz Bend occupies an old alluvial terrace, high above the active flood plain of the Gauley River.

Figure 30.—An unnamed stream plunges over a cliff formed by the massive Lower Nuttall sandstone, a member of the New River Formation.

Alluvial soils on active flood plains are generally considered young. Because of the dynamic nature of the flood plain, these soils have not been stable long enough for distinct genetic horizons to form (fig. 34). The soils often do not exhibit any distinct changes in color or development of structure below the soil surface. In some areas, however, there are abrupt changes in texture or stratification, a result of different depositional events. Alluvial soils may also exhibit dark horizons in the subsoil where

Figure 31.—Profile of a taxadjunct of the Laidig series (fine-loamy, siliceous, semiactive, mesic Typic Fragiudults). This photo illustrates the strong colors and well developed structure of a mature soil. Scale is centimeters.

old surface horizons, which have been darkened by organic matter, are buried by younger alluvial deposits.

The alluvium on the flood plain of the Meadow and Gauley Rivers is mainly of remote origin. It has been carried into the park by floodwaters from distant areas of the watershed. It has been washed from acidic upland soils which formed from geologic parent materials similar to those found in the park. These soils include members

Figure 32.—Profile of a Layland soil (loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts). In contrast to Laidig soils, Layland soils are young and do not exhibit strong colors or well developed structure in the subsoil. Scale is in inches.

of the Craigsville and Pope series. Craigsville and Pope soils are acid and contain large volumes of sand and rock fragments. They commonly occur along high-energy streams.

In addition, a small area of Typic Haplorthods was found during fieldwork on an elevated island in the Meadow River (fig. 35). Because these soils are very limited in extent and do not fit the concept of any known soil series, they are named at a higher level of Soil Taxonomy. They formed in sandy materials under a heavy

Figure 33.—The steep gradient and swift currents of Peters Creek, a tributary of the Gauley River.

canopy of eastern hemlock (*Tsuga canadensis*) and rhododendron (*Rhododendron maximum*). The duff from these plants acidifies the soil and facilitates the leaching and translocation of iron, aluminum, and organic compounds downward through the soil. The result is a concentration of these compounds in a reddish brown to black “spodic” horizon. This process, called podzolization, is also facilitated by the sandy texture of the alluvial parent material. In this region of the Appalachians, these types of soils (Spodosols) commonly occur on summits at high elevations, under a canopy of red spruce (*Picea rubens*). They rarely occur at this elevation (that of the island), especially on a flood plain.

The alluvial terrace at Koontz Bend is an ancient landform. The alluvium that is the parent material for the soils on this terrace was deposited on the flood plain of the Gauley River eons ago. The active flood plain of the river is presently about 61 meters (200 feet) lower in elevation than the terrace. The geologic strata under the site are dominated by the massive Lower Nuttall sandstone, a hard bedrock that is resistant to weathering. It took a very long time for the Gauley River to cut through these strata to its present elevation. The oldest soils at this site are members of the Cottonbend series. A profile of a Cottonbend soil exhibits evidence of the soil’s great age (fig. 36). A deep red color (hue of 2.5YR) developed in the subsoil from the accumulation of iron oxides, and there is an abundant accumulation of translocated clay minerals (argillic horizon) very deep in the soil profile (230 centimeters). These clay minerals have formed visible “skins” on the faces of structural units, in pores, and on rock fragments. These features, along with the presence of highly weathered sandstone paragravel in the substratum, indicate that this soil has undergone intense weathering for a very long period of time.

Figure 34.—Profile of the Craigsville series (loamy-skeletal, mixed, superactive, mesic Fluventic Dystrudepts). Craigsville soils, which occur on active flood plains, have not been stable long enough to form distinct genetic horizons. Scale is in centimeters.

Members of the Allegheny series can also be observed at Koontz Bend. Allegheny soils occur at an elevation slightly lower than that of Cottonbend soils and, although very old, are not as old as Cottonbend soils. Allegheny soils exhibit well developed structure and an argillic horizon but have not been in place long enough to have developed the deep red colors occurring in Cottonbend soils.

Soils That Formed in Colluvium

The steep slopes in the survey area, along with abundant rainfall, contribute to an abundance of colluvium, the most extensive parent material in the park. Colluvial soils occupy about 57 percent of the land area in the park.

When gravity pulls colluvium downslope quickly, as in a landslide, it tends to accumulate at the base of slopes (footslopes or toeslopes). When colluvium moves

Figure 35.—The upper profile of Typic Haplorthods on an elevated island in the Meadow River. The highly organic black surface horizon (A horizon) is underlain by a light gray horizon (E horizon) that has been leached by organic acids and a black spodic horizon (Bhs horizon). The spodic horizon formed from the concentration of iron, aluminum, and organic compounds that were translocated downward through the soil profile.

slowly, it tends to accumulate higher on the slope (on concave surfaces, such as coves) by a process commonly called soil creep (or solifluction). Both this process and landslides are facilitated when soils are saturated with water. Below the cliffs formed by the Lower Nuttall sandstone, much of the colluvium is mantled by stones and boulders that have toppled from the cliffs (fig. 37). Some of the boulders are huge in dimension, more than 12 meters (40 feet) along their longest axis.

Like alluvium, the accumulation of colluvium is a dynamic process. Therefore, colluvial landforms, and the soils occupying them, tend to be relatively young. This is especially true of the colluvial soils on the very steep walls (backslopes) of the gorges of the Gauley and Meadow Rivers. These colluvial soils have not been stable long enough for the development of strong structure, the accumulation of translocated clay minerals, or the development of distinctive genetic horizons in the subsoil. Examples of young colluvial soils in the park are Highsplint, Layland, and Sharondale.

Layland soils are very strongly acid and formed in colluvium derived mainly from the New River Formation. Both Highsplint and Sharondale soils formed in colluvium derived from the Kanawha Formation. Highsplint soils are strongly acid, while Sharondale soils are moderately acid. Sharondale soils occur exclusively in very steep, north-facing mountain coves.

Colluvial landforms on gently sloping to strongly sloping footslopes tend to be older and more stable. The soils that formed on these landforms include Buchanan and Laidig. Both Buchanan and Laidig soils have an argillic horizon. They also contain a genetic horizon deep in the subsoil called a fragipan. The fragipan is a dense and

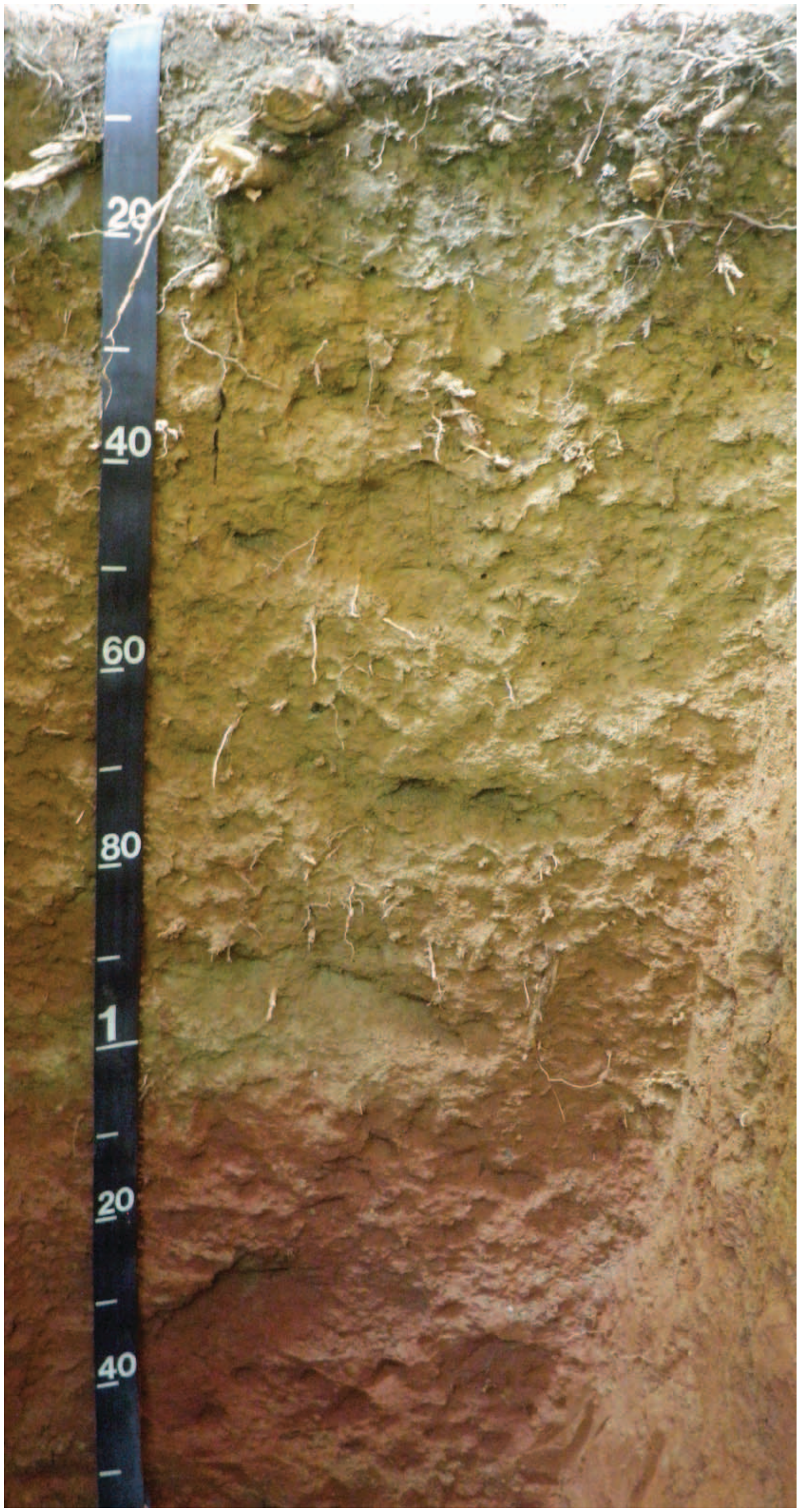

Figure 36.—Profile of a Cottonbend soil (fine-loamy, siliceous, semiactive, mesic Typic Paleudults) showing the deep red color (hue of 2.5YR) in the subsoil, evidence that this soil has undergone intense weathering for a very long period of time. Scale is in centimeters.

Figure 37.— A huge boulder which has toppled from the cliffs formed by the Lower Nuttall sandstone. Soils occurring under the mantle of boulders and stones are members of the Layland and Laidig series.

brittle horizon that impedes the growth of plant roots and the flow of water downward through the soil profile (fig. 38). In Buchanan soils, the fragipan is closer to the surface than in Laidig soils.

Soils That Formed in Residuum

Residuum is the second most abundant parent material in the park. Soils that formed in residuum occupy about 30 percent of the survey area.

Residual soils mainly occur on old and stable landforms, such as gently sloping to moderately steep summits and shoulder slopes. Most of these soils are considered mature. They have undergone pedogenesis long enough to develop structure and strong color. Most of them also have an argillic horizon. Members of the Dekalb and Berks series are exceptions. These soils occur on steep slopes or formed in materials that are resistant to weathering. These factors combine to slow the pedogenic process and prevent the soils from developing the characteristics of a mature soil.

In Gauley River National Recreation Area, with one exception, the differences in the residuum derived from members of the New River Formation and members of the Kanawha Formation are not enough to affect the classification of the soils or their use and management. The exception is Berks soils, which occur exclusively on the convex mountain slopes underlain by the Kanawha Formation. The other residual soils in the park (Clifftop, Dekalb, Fenwick, and Nallen) formed in bedrock members of either geologic formation. Berks soils are strongly acid and have medium natural fertility. All of the other residual soils in the park are very strongly acid and have low natural fertility.

The fine-earth textures of residual soils are mostly inherited from the parent bedrock. For example, Clifftop and Berks soils formed in residuum derived mainly from

shale or siltstone. As a result, these soils have fine-earth textures that are dominated by silt-sized particles and have a moderate amount of clay and very little sand. In contrast, Dekalb and Nallen soils formed in residuum derived mainly from sandstone (fig. 39). These soils have inherited fine-earth textures that are dominated by sand-sized particles and have lesser amounts of silt and very little clay.

Good examples of soils that formed in residuum can be found on a summit in a bend of the Gauley River, opposite the mouth of Ramsey Branch.

Anthropogenic Soils That Formed in Human-Transported Materials (HTM)

Anthropogenic soils occupy about 3 percent of the survey area. These soils are on landscapes that have been drastically disturbed by humans with the aid of heavy machinery, including road beds, railroad beds, the spillway of the Summersville Dam, and areas that have been graded for development. They are the youngest soils in the park. The parent materials of these soils have not been in place long enough for pedogenic processes to form any of the characteristic properties of a mature soil. These soils are classified and named as Udorthents and Lithic Udorthents.

Udorthents are soils that formed in HTM. The properties of these soils are so variable that they cannot be classified as a soil series. In layman's terms, these soils are "cut and fill" materials. Some Udorthents have been graded to meet site needs and tend to be deep or very deep in areas that have been filled and raised above the original ground level. Lithic Udorthents formed in the substratum of native soils or in weathered bedrock exposed by excavation. These soils are shallow and droughty.

Figure 38.—A road cut through an area of Laidig soils (fine-loamy, siliceous, semiactive, mesic Typic Fragiudults). The dense fragipan in the subsoil forms a bulge in the road bank. During wet periods, water seeps out of the road bank at the top of the slowly permeable fragipan.

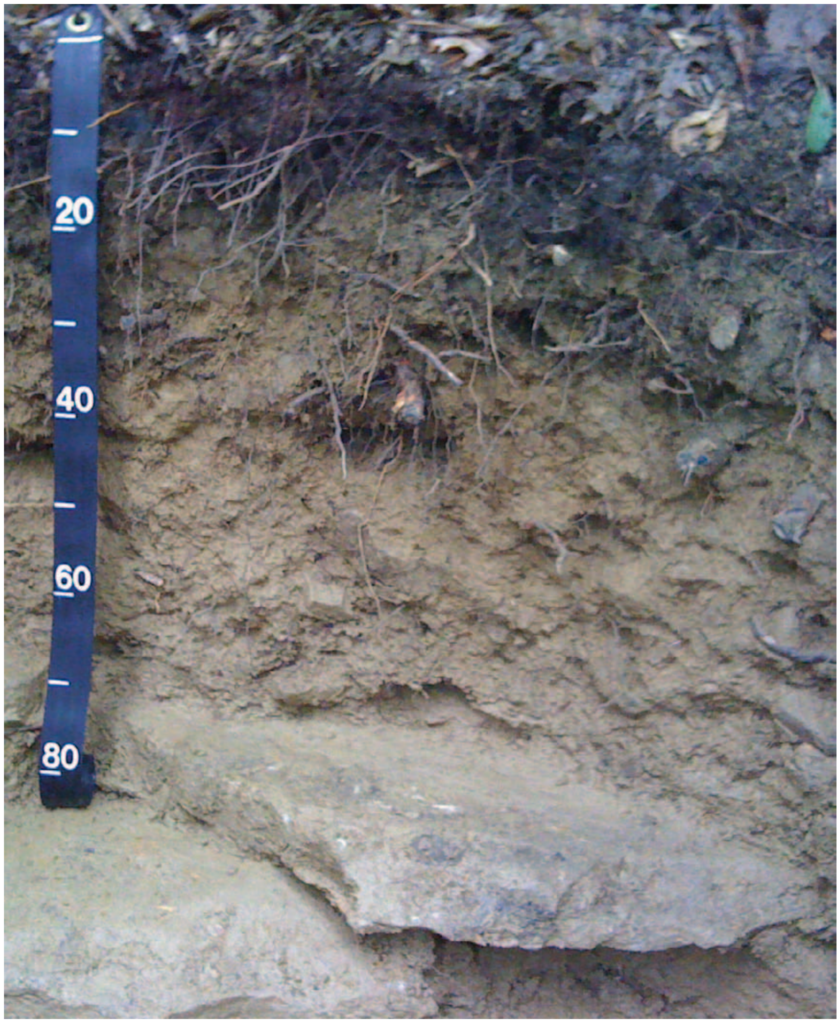

Figure 39.—Profile of a Dekalb soil (loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts). Dekalb soils formed in residuum derived from sandstone bedrock. The bedrock in the photo begins at a depth of about 70 centimeters (28 inches). Scale is in centimeters.

Examples of Lithic Udorthents can be seen in the area excavated (“cut”) to construct the emergency spillway for the Summersville Dam.

Climate

Temperature and moisture influence soil formation and are the two most commonly measured features of climate. Weathering is most active when soils are moist and warm since these conditions are conducive to rapid chemical reactions. Cooler temperatures result in slower chemical reactions. While average temperatures and amounts of precipitation are important, the extremes of weather in any given locale also play a major role in soil formation.

During periods of rainfall or snowmelt, water carrying dissolved or suspended solids moves through the soil in a process called leaching. The leaching process becomes active with the onset of rainfall or snowmelt. Differences in temperature and the amount of moisture cause different patterns of weathering and leaching in the

soil. Seasonal and daily changes in temperature affect moisture availability, biological activity, rates of chemical reactions, and kinds of vegetation.

Present-day climate variations are the result of topography and relief. In most areas of the United States, temperature generally decreases as elevation increases and precipitation generally increases as elevation increases. As the amount of precipitation increases, the extent of leaching and the amount of vegetation generally increase to a point where they then decrease because of decreasing temperatures. Colder temperatures result in less leaching because of decreased microbial growth, decreased vegetation, and possibly frozen soil. Fluctuations in temperature and moisture affect the rate of organic matter decomposition and accumulation and the weathering of minerals. For these reasons, the cycling of bases is pronounced in areas of warm climate and large amounts of vegetation.

The climate of Gauley River National Recreation Area is a humid continental type characterized by marked seasonal temperature changes and relatively uniform precipitation throughout the year (Vanderhorst et al., 2010). Climate data recorded at Summersville Lake (at an elevation of 536 meters or 1,760 feet) show a mean annual air temperature of 10.6 degrees C (51.0 degrees F), a mean annual precipitation of 1,207 millimeters (47.52 inches), and an average of 163 frost-free days per year.

This climate profile is a somewhat intense weathering regime with regard to soil formation. Because the soils in the survey area are not dry or frozen for long periods, soil formation processes are active throughout the year. All the correlated soils in the park have a mesic (temperate) soil temperature regime and a udic (usually moist) soil moisture regime.

Differences in climate can result in differences in soils. This is evidenced by Sharondale soils, which occur in coves on mountain backslopes with north aspect (fig. 40). The coves are cooler and stay moist longer than other positions on the landscape. These conditions slow the oxidation of organic matter and allow it to accumulate in the surface layer of the soil. The result is a soil with a thick, dark, highly organic surface horizon (mollic epipedon) which holds nutrients, increases the soil’s array of micro and macro fauna, increases the water-holding capacity, and creates an ideal environment for the growth of plants. Sharondale soils are very productive woodland soils and produce some of the finest and most diverse stands of hardwood trees, wildflowers, and herbs in the central Appalachians.

Plant and Animal Organisms

Plants, animals, micro-organisms, and humans affect the formation of soils. Flora, such as fungi and bacteria, can help to decompose organic matter and add nutrients to the soil. Animals and micro-organisms mix soils and form burrows and pores. Earthworms are one example of animals that have a major affect in soil formation. A single earthworm can produce almost 10 pounds of castings a year. Plant roots open channels in the soils. Abandoned tunnels commonly are filled with loose material from the overlying horizons and transmit water more readily than the surrounding undisturbed soil material.

Different types of roots have different effects on soils. Grass roots are fibrous near the surface and decompose easily, adding organic matter to the soil. Fine grass roots can extend below the surface for many feet. Plant roots also help to develop soil structure and aggregate stability. Vegetation increases soil stability by protecting the surface against erosion. Taproots, which are thicker and stronger than most roots, can open pathways through dense and, in some cases, otherwise impermeable layers. Micro-organisms affect chemical exchanges between roots and soil material, such as processing nitrogen into more readily available forms for plant uptake. Humans also can mix the soil extensively, such as with farming, rail line construction, and dam construction. Soil profiles in some of the flatter ridgetop areas of the park show

Figure 40.—Profile of a Sharondale soil in a north-facing mountain cove. The dark surface horizon, which is about 51 centimeters (20 inches) thick, results from the accumulation or organic matter. Sharondale soils are some of the most productive woodland soils in the central Appalachians. Scale is in inches.

evidence of past farming. These soils show mixing in the top layers from plowing and cultivation. Some of these areas are now covered by forest but were cleared and farmed as recently as 60 years ago.

The native vegetation depends on climate, topography, and biological factors as well as many soil factors, such as soil density, depth to bedrock, chemistry, temperature, and moisture. Leaves from plants fall to the surface and decompose on the soil. Organisms help to more rapidly decompose these leaves and mix them

with the upper part of the soil, resulting in the cycling of nutrients and energy back to vegetation. Trees and shrubs have large roots that may grow to considerable depths and aid in the fracturing of underlying rocks.

With the exception of the anthropogenic soils and Typic Haplorthods, the soils in the park formed a under mixed mesophytic (hardwood) forest that represents one of the most biologically diverse temperate regions of the world (Loucks et al., 2001).

Most of the forest soils are topped by thin, dark organic layers formed from the breakdown of forest litter, including leaves and woody debris. Because of the recycling effect of the deciduous forest, the base cations (nutrients) are concentrated in the upper part of the soil profiles (epipedons). This effect is very pronounced in Sharondale soils, which have accumulated enough base cations (a base saturation of 50 percent or more to a depth of 180 centimeters) to classify as members of the Mollisol soil order. Most Mollisols form under grassland vegetation in calcareous parent materials. It is very unusual to have a Mollisol form under hardwood trees in parent materials that are mostly acid. In Sharondale soils, the recycling effect is magnified by the high amounts of organic matter which efficiently adsorb the base cations.

Topography

Topography refers to the differences in shape and elevation of landscapes. The overall landscape in the park is the result of erosional processes (fig. 41). These

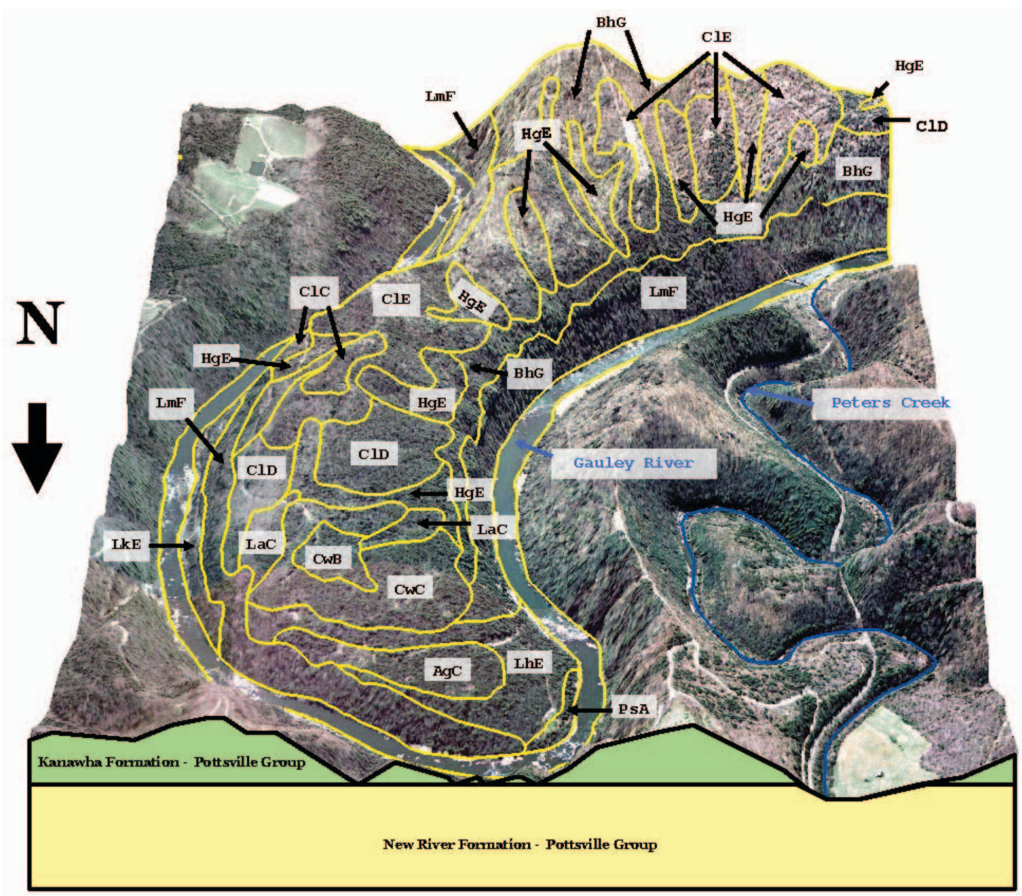

Figure 41.— A view of Gauley River National Recreation Area looking south across the ancient alluvial terrace at Koontz Bend.

processes may have occurred in response to changes in climate, fluctuating sea levels, and/or tectonic activities. Cyclic periods of landscape stability and instability influence the types of soils that formed on this landscape.

Slope and aspect of the overall landscape can affect the moisture content and temperature of the soil. Steep slopes facing the sun are warmer. The effects of aspect on soils in this survey area were not great enough to delineate at the scale of mapping.

On most landscapes, landforms that shed water the fastest tend to have the shallowest soils because the soils erode and lose their topsoil as they form. Thus, soils on convex portions of steep backslopes (nose slopes) are thinner than soils on less sloping concave surfaces (coves) that concentrate water and also receive soil materials from areas upslope. Examples of soils on steep, convex slopes include Clifftop and Berks soils, which are less than 1 meter deep to bedrock. In contrast, soils on linear to concave surfaces, such as Highsplint and Layland soils, are more than 2 meters (sometimes much more) deep to bedrock. Soils on steep slopes also show less development than soils on gentle slopes since they shed water faster and less water moves through the soil profile to facilitate pedogenesis. Soil-forming factors continue to affect soils even on more stable landforms. Materials are deposited on the surface, and materials are blown or washed away from the surface. Additions, removals, and alterations are slow or rapid, depending on climate, landscape position, and biological activity.

The oldest soils in the park, Cottonbend soils, occur on the highest portion of the terrace (in map units CwB and CwC). Allegheny soils are on a lower terrace that is younger in age (in map unit AgC). The active flood plain of the river is occupied by young soils, such as Pope and Craigsville soils (in map unit PsA). The moderately deep Clifftop soils formed in residuum and occur on convex summits that are relatively old and stable (in map units ClC, ClD, and ClE). Berks soils are younger and occur on very steep convex slopes on mountainsides (in convex parts of map unit BhG). Soils that formed in colluvium are the most extensive type of soils in the park. Layland and Laidig soils formed in colluvium derived from materials dominantly weathered from the New River Formation (in map units LaC, LhE, LkE, and LmF). Colluvium derived from the Kanawha Formation is the parent material of Highsplint and Sharondale soils (in map unit HgE and in linear and concave areas of map unit BhG).

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the “Soil Survey Manual.”

Drainage, surface. Runoff, or surface flow of water, from an area.

Ecological site. An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building

up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Ground water. Water filling all the unblocked pores of the material below the water table.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

K_{sat}. Saturated hydraulic conductivity. (See Permeability.)

Leaching. The removal of soluble material from soil or other material by percolating water.

LEP. See Linear extensibility percent.

Linear extensibility (LE). Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^1/_3$- or $^1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Linear extensibility percent. Refers to the percent change in linear extensibility.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.
Low strength. The soil is not strong enough to support loads.
Major land resource area (MLRA). A geographic area that generally has similar soils, vegetation, water, climate, elevation, relief, and land use characteristics.
Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.
Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.
Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.
Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.
Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.
Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)
Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.
Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.
Parent material. The unconsolidated organic and mineral material in which soil forms.
Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.
Pedon. The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.
Percolation. The movement of water through the soil.
Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as “saturated hydraulic conductivity,” which is defined in the “Soil Survey Manual.” In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as “permeability.” Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.
pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.
Plastic limit. The moisture content at which a soil changes from semisolid to plastic.
Plowpan. A compacted layer formed in the soil directly below the plowed layer.
Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.
Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.
Potential native plant community. See Climax plant community.
Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.
Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.
Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.
Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.
Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.
Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.
Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.
Relief. The elevations or inequalities of a land surface, considered collectively.
Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.
Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.
Root zone. The part of the soil that can be penetrated by plant roots.
Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface

runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Series, soil. A group of soils that have profiles that are almost alike. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate

and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

Table 1.—Temperature and Precipitation

(Recorded in the period 1971-2000 at Summersville Lake, West Virginia)

Month	Temperature (degrees F)						Precipitation (inches)				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temp. higher than--	2 years in 10 will have-- Minimum temp. lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snow-fall
January--	39.3	20.1	29.7	67	-11	37	3.63	2.04	5.13	8	16.1
February-	43.0	22.1	32.5	72	-5	54	3.05	1.96	4.10	8	10.2
March----	52.2	29.4	40.8	79	5	154	3.90	2.61	4.92	9	6.0
April----	62.7	37.9	50.3	86	19	331	3.85	2.51	5.09	9	1.5
May------	70.9	47.0	58.9	87	29	587	4.77	3.15	6.39	10	0.0
June-----	77.6	55.4	66.5	90	39	795	4.44	2.39	6.20	9	0.0
July-----	81.2	59.9	70.6	91	46	948	5.53	3.98	7.14	8	0.0
August---	80.0	58.7	69.3	91	45	909	4.71	3.05	6.19	7	0.0
September	74.3	52.6	63.4	89	36	700	3.57	2.01	5.09	7	0.0
October--	64.1	40.7	52.4	81	23	393	3.31	1.83	4.63	7	0.2
November	53.5	32.6	43.0	77	13	178	3.27	1.93	4.38	7	2.0
December-	43.5	24.6	34.1	69	-1	65	3.49	2.20	4.48	8	7.1
Yearly:											
Average	61.9	40.1	51.0	---	---	---	----	----	----	---	---
Extreme	94	-20	---	92	-13	---	----	----	----	---	---
Total--	---	---	---	---	---	5,152	47.52	41.42	53.01	97	43.1

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

Table 2.—Freeze Dates in Spring and Fall

(Recorded in the period 1971-2000 at Summersville Lake, West Virginia)

Probability	Temperature (degrees F)		
	24 degrees or lower	28 degrees or lower	32 degrees or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 17	May 3	May 14
2 years in 10 later than--	Apr. 12	Apr. 28	May 10
5 years in 10 later than--	Apr. 3	Apr. 18	May 2
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 17	Oct. 8	Sept. 29
2 years in 10 earlier than--	Oct. 24	Oct. 14	Oct. 3
5 years in 10 earlier than--	Nov. 7	Oct. 26	Oct. 13

Table 3.—Growing Season

(Recorded in the period 1971-2000 at Summersville Lake, West Virginia)

Probability	Daily minimum temperature (degrees F) during growing season		
	Higher than 24 degrees	Higher than 28 degrees	Higher than 32 degrees
	Days	Days	Days
9 years in 10	191	165	147
8 years in 10	200	173	153
5 years in 10	217	190	163
2 years in 10	235	207	173
1 year in 10	244	216	178

Table 4.—Acres, Hectares, and Proportionate Extent of the Map Units

Map symbol	Map unit name	Acres	Hectares	Percent
AgC	Allegheny loam, 8 to 15 percent slopes	12	5	0.1
BhG	Berks-Highsplint-Sharondale complex, 35 to 80 percent slopes, very stony	1,961	794	17.4
BuC	Buchanan loam, 8 to 15 percent slopes	19	8	0.2
ClB	Clifftop channery silt loam, 3 to 8 percent slopes	45	18	0.4
ClC	Clifftop channery silt loam, 8 to 15 percent slopes	262	106	2.3
ClD	Clifftop channery silt loam, 15 to 25 percent slopes	266	108	2.4
ClE	Clifftop channery silt loam, 25 to 35 percent slopes	523	212	4.6
CmC	Clifftop channery silt loam, 3 to 15 percent slopes, very stony	29	12	0.3
CwB	Cottonbend loam, 3 to 8 percent slopes	6	2	*
CwC	Cottonbend loam, 8 to 15 percent slopes	28	11	0.2
DkC	Dekalb very channery loam, 3 to 15 percent slopes, extremely stony	43	17	0.4
DrE	Dekalb-Rock outcrop complex, 15 to 35 percent slopes, extremely stony	149	60	1.3
FeB	Fenwick silt loam, 3 to 8 percent slopes	13	5	0.1
FeC	Fenwick silt loam, 8 to 15 percent slopes	29	12	0.3
HgE	Highsplint channery loam, 15 to 35 percent slopes, very stony	402	163	3.6
LaC	Laidig channery loam, 3 to 15 percent slopes, rubbly	233	94	2.1
LbC	Laidig channery loam, 3 to 15 percent slopes, very rubbly	41	17	0.4
LcE	Laidig-Clifftop complex, 15 to 35 percent slopes, very stony	663	269	5.9
LdF	Layland-Clifftop complex, 35 to 70 percent slopes, very stony	611	247	5.4
LhE	Layland-Laidig complex, 15 to 35 percent slopes, rubbly	312	126	2.8
LkE	Layland-Laidig complex, 15 to 35 percent slopes, very rubbly	613	248	5.4
LmF	Layland-Rock outcrop complex, 35 to 70 percent slopes, very rubbly	3,350	1,357	29.8
LuC	Lithic Udorthents, leveled land, 0 to 15 percent slopes	192	78	1.7
LxG	Lithic Udorthents-Rock outcrop complex, cut land, 5 to 100 percent slopes	1	0	*
NaB	Nallen loam, 3 to 8 percent slopes	3	1	*
NaC	Nallen loam, 8 to 15 percent slopes	104	42	0.9
NaD	Nallen loam, 15 to 25 percent slopes	134	54	1.2
PsA	Pope sandy loam, 0 to 3 percent slopes, rarely flooded	34	14	0.3
PvA	Pope-Craigsville complex, 0 to 3 percent slopes, occasionally flooded	83	34	0.7
Rw	Riverwash, frequently flooded	8	3	*
ThB	Typic Haplorthods, 0 to 8 percent slopes, rubbly, rarely flooded	2	1	*
UgC	Udorthents, graded, 0 to 15 percent slopes	30	12	0.3
UgF	Udorthents, graded, 15 to 55 percent slopes	45	18	0.4
Ur	Udorthents, railroad grade	275	111	2.4
Uu	Udorthents-Urban land complex, highways	9	4	*
W	Water	478	194	4.2
Wr	Water-Rubble land complex	248	100	2.2
	Total	11,256	4,559	100.0

* Less than 0.1 percent.

Table 5.—Land Capability and Yields per Acre of Crops and Pasture

(Yields are those that can be expected under a high level of management. They are for nonirrigated areas. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Map symbol and soil name	Land capability	Corn	Grass-legume hay	Kentucky bluegrass	Oats	Wheat
		Bu	Tons	AUM	Bu	Bu
AgC:		115.00	3.50	5.50	75.00	45.00
Allegheny	3e					
BhG:		---	---	---	---	---
Berks	7s					
Highsplint	7s					
Sharondale	7s					
BuC:		90.00	3.00	4.50	60.00	35.00
Buchanan	3e					
ClB:		90.00	3.00	4.50	65.00	40.00
Clifftop	2e					
ClC:		85.00	3.00	4.50	60.00	35.00
Clifftop	3e					
ClD:		75.00	2.50	4.00	55.00	30.00
Clifftop	4e					
ClE:		---	---	3.00	---	---
Clifftop	6e					
CmC:		---	---	3.50	---	---
Clifftop	6s					
CwB:		130.00	4.00	5.50	80.00	64.00
Cottonbend	2e					
CwC:		114.00	3.50	4.70	75.00	56.00
Cottonbend	3e					
DkC:		---	---	---	---	---
Dekalb	7s					
DrE:		---	---	---	---	---
Dekalb	7s					
Rock outcrop	8s					
FeB:		100.00	3.00	4.50	65.00	40.00
Fenwick	2e					
FeC:		90.00	3.00	4.50	65.00	35.00
Fenwick	3e					
HgE:		---	---	3.00	---	---
Highsplint	6s					
LaC:		---	---	---	---	---
Laidig	7s					
LbC:		---	---	---	---	---
Laidig	7s					

Table 5.—Land Capability and Yields per Acre of Crops and Pasture—Continued

Map symbol and soil name	Land capability	Corn	Grass-legume hay	Kentucky bluegrass	Oats	Wheat
		Bu	Tons	AUM	Bu	Bu
LcE:		---	---	3.00	---	---
Laidig	6s					
Clifftop	6s					
LdF:		---	---	---	---	---
Layland	7s					
Clifftop	7s					
LhE:		---	---	---	---	---
Layland	7s					
Laidig	7s					
LkE:		---	---	---	---	---
Layland	7s					
Laidig	7s					
LmF:		---	---	---	---	---
Layland	7s					
Rock outcrop	8s					
LuC:		---	---	---	---	---
Lithic Udorthents, leveled land	8s					
LxG:		---	---	---	---	---
Lithic Udorthents, cut land	8s					
Rock outcrop	8s					
NaB:		85.00	2.50	4.00	60.00	30.00
Nallen	2e					
NaC:		75.00	2.50	4.00	55.00	30.00
Nallen	3e					
NaD:		65.00	2.00	3.50	50.00	25.00
Nallen	4e					
PsA:		100.00	3.00	4.50	70.00	40.00
Pope, rarely flooded	1					
PvA:		89.00	2.40	4.00	64.00	46.00
Pope, occasionally flooded	2w					
Craigsville, occasionally flooded	2w					
Rw:		---	---	---	---	---
Riverwash, frequently flooded	8w					
ThB:		---	---	---	---	---
Typic Haplorthods, rarely flooded	7s					

Table 5.—Land Capability and Yields per Acre of Crops and Pasture—Continued

Map symbol and soil name	Land capability	Corn	Grass-legume hay	Kentucky bluegrass	Oats	Wheat
		Bu	Tons	AUM	Bu	Bu
UgC:		---	---	---	---	---
Udorthents, graded------	7e					
UgF:		---	---	---	---	---
Udorthents, graded------	8e					
Ur:		---	---	---	---	---
Udorthents, railroad grade------------------	8e					
Uu:		---	---	---	---	---
Udorthents, highways----	7e					
Urban land, highways----	8s					
W.						
Water						
Wr:						
Water.						
Rubble land, frequently flooded----------------	8s					

Table 6.—Prime and Other Important Farmland

(Only the soils considered prime or important farmland are listed. Urban or built-up areas of the soils listed are not considered prime or important farmland)

Map unit symbol	Map unit name	Farmland classification
ClB	Clifftop channery silt loam, 3 to 8 percent slopes	All areas are prime farmland
CwB	Cottonbend loam, 3 to 8 percent slopes	All areas are prime farmland
FeB	Fenwick silt loam, 3 to 8 percent slopes	All areas are prime farmland
NaB	Nallen loam, 3 to 8 percent slopes	All areas are prime farmland
PsA	Pope sandy loam, 0 to 3 percent slopes, rarely flooded	All areas are prime farmland
PvA	Pope-Craigsville complex, 0 to 3 percent slopes, occasionally flooded	All areas are prime farmland
AgC	Allegheny loam, 8 to 15 percent slopes	Farmland of statewide importance
BuC	Buchanan loam, 8 to 15 percent slopes	Farmland of statewide importance
ClC	Clifftop channery silt loam, 8 to 15 percent slopes	Farmland of statewide importance
ClD	Clifftop channery silt loam, 15 to 25 percent slopes	Farmland of statewide importance
CwC	Cottonbend loam, 8 to 15 percent slopes	Farmland of statewide importance
FeC	Fenwick silt loam, 8 to 15 percent slopes	Farmland of statewide importance
NaC	Nallen loam, 8 to 15 percent slopes	Farmland of statewide importance
NaD	Nallen loam, 15 to 25 percent slopes	Farmland of statewide importance

Table 7.—Hydric Soils

(This report lists only those map unit components that are rated as hydric. Definitions of hydric criteria codes are included at the bottom of the report)

Map unit symbol and map unit name	Component	Percent of map unit	Hydric rating	Landform	Hydric soils criteria: Hydric criteria code	Hydric soils criteria: Meets saturation criteria	Hydric soils criteria: Meets flooding criteria	Hydric soils criteria: Meets ponding criteria
AgC: Allegheny loam, 8 to 15 percent slopes	Knowlton, occasionally ponded	2	Yes	depressions on high stream terraces	2B3	Yes	No	No
LaC: Laidig channery loam, 3 to 15 percent slopes, rubbly	Atkins, occasionally flooded	5	Yes	flood plains in mountain valleys	2B3	Yes	No	No
PsA: Pope sandy loam, 0 to 3 percent slopes, rarely flooded	Atkins, occasionally flooded	5	Yes	nearly level flood plains	2B3	Yes	No	No
PvA: Pope-Craigsville complex, 0 to 3 percent slopes, occasionally flooded	Atkins, occasionally flooded	5	Yes	nearly level flood plains	2B3	Yes	No	No
Ur: Udorthents, railroad grade	Endoaquepts, frequently ponded	1	Yes	closed depressions located behind the rail beds on mountain slopes	3, 2B3	Yes	No	Yes

Explanation of hydric criteria codes:

1. All Histels (except for Folistels), and Histosols (except for Folists), which are, by definition, saturated.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
   - A. are somewhat poorly drained and have a water table at the surface (0.0 feet) during the growing season, or
   - B. are poorly drained or very poorly drained and have either:
     - 1.) a water table at the surface (0.0 feet) during the growing season if textures are coarse sand, sand, or fine sand in all layers within a depth of 20 inches, or
     - 2.) a water table at a depth of 0.5 foot or less during the growing season if permeability is equal to or greater than 6.0 in/hr in all layers within a depth of 20 inches, or
     - 3.) a water table at a depth of 1.0 foot or less during the growing season if permeability is less than 6.0 in/hr in any layer within a depth of 20 inches.
3. Soils that are frequently ponded for periods of long or very long duration during the growing season.
4. Soils that are frequently flooded for periods of long or very long duration during the growing season.

Table 8.—Landscape, Parent Material, and West Virginia Grassland Suitability Class

(MAP is the mean annual precipitation)

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	WV grassland suitability class name and number
	Pct	Pct	Meters	mm				
AgC:								
Allegheny----------	80	8-15	302-328	1052-1346	Mountains	High stream terrace in river valley	Fine-loamy alluvium	Acid Loams (AL3)
BhG:								
Berks--------------	35	35-80	211-558	1052-1346	Mountains	Convex mountain slope	Residuum weathered from interbedded sedimentary rock	Not Suited (NS)
Highsplint---------	30	35-80	211-558	1052-1346	Mountains	Mountain slope	Very stony colluvium derived from interbedded sedimentary rock	Not Suited (NS)
Sharondale---------	20	35-80	211-558	1052-1346	Mountains	North-facing mountain slope	Very stony colluvium derived from interbedded sedimentary rock	Not Suited (NS)
BuC:								
Buchanan-----------	80	8-15	238-489	1052-1346	Mountains	Drainageway, footslope, and mountain slope	Loamy colluvium derived from sandstone and siltstone	Acid Loams (AL2)
ClB:								
Clifftop-----------	80	3-8	382-591	1052-1346	Mountains	Ridge	Acid fine-loamy residuum weathered from shale and siltstone	Acid Loams (AL3)
ClC:								
Clifftop-----------	80	8-15	356-591	1052-1346	Mountains	Ridge	Acid fine-loamy residuum weathered from shale and siltstone	Acid Loams (AL3)
ClD:								
Clifftop-----------	75	15-25	319-551	1052-1346	Mountains	Ridge	Acid fine-loamy residuum weathered from shale and siltstone	Acid Loams (AL3)

Table 8.—Landscape, Parent Material, and West Virginia Grassland Suitability Class—Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	WV grassland suitability class name and number
	Pct	Pct	Meters	mm				
ClE:								
Clifftop-----------	70	25-35	221-571	1052-1346	Mountains	Convex mountain slope	Acid fine-loamy residuum weathered from shale and siltstone	Acid Hills (AH3)
CmC:								
Clifftop-----------	75	3-15	321-455	1052-1346	Mountains	Ridge	Acid fine-loamy residuum weathered from shale and siltstone	Very Rocky, Acid Soils (RA3)
CwB:								
Cottonbend---------	90	3-8	342-349	1052-1346	Mountains	High stream terrace in river valley	Alluvium derived from sedimentary rock	Acid Loams (AL3)
CwC:								
Cottonbend---------	90	8-15	325-359	1052-1346	Mountains	High stream terrace in river valley	Alluvium derived from sedimentary rock	Acid Loams (AL3)
DkC:								
Dekalb-------------	80	3-15	327-603	1052-1346	Mountains	Ridge	Acid loamy residuum weathered from sandstone	Very Rocky, Acid Soils (RA3)
DrE:								
Dekalb-------------	55	15-35	331-610	1052-1346	Mountains	Mountain slope	Acid loamy residuum weathered from sandstone	Not suited (NS)
Rock outcrop-------	15	None assigned	331-610	1052-1346	Mountains	Sandstone cliff	Sandstone	Not Suited (NS)
FeB:								
Fenwick------------	85	3-8	411-530	1052-1346	Mountains	Broad ridge	Residuum weathered from sandstone and shale	Acid Loams (AL3)
FeC:								
Fenwick------------	85	8-15	403-586	1052-1346	Mountains	Broad ridge	Residuum weathered from sandstone and shale	Acid Loams (AL3)

Table 8.—Landscape, Parent Material, and West Virginia Grassland Suitability Class—Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	WV grassland suitability class name and number
	Pct	Pct	Meters	mm				
HgE:								
Highsplint	70	15-35	320-352	1052-1346	Mountains	Mountain slope	Very stony colluvium derived from interbedded sedimentary rock	Very Rocky, Acid Soils (RA3)
LaC:								
Laidig	70	3-15	327-578	1052-1346	Mountains	Drainageway, footslope, and mountain slope	Rubbly colluvium derived from interbedded sedimentary rock	Very Rocky, Acid Soils (RA3)
LbC:								
Laidig	75	3-15	252-468	1052-1346	Mountains	Drainageway, footslope, and mountain slope	Very rubbly colluvium derived from interbedded sedimentary rock	Not Suited (NS)
LcE:								
Laidig	45	15-35	212-613	1052-1346	Mountains	Drainageway, footslope, and mountain slope	Very stony colluvium derived from interbedded sedimentary rock	Very Rocky, Acid Soils (RA3)
Clifftop	25	15-35	212-613	1052-1346	Mountains	Convex mountain slope	Acid fine-loamy residuum weathered from shale and siltstone	Very Rocky, Acid Soils (RA3)
LdF:								
Layland	60	35-70	257-586	1052-1346	Mountains	Mountain slope	Very stony colluvium derived from sandstone and siltstone	Very Rocky, Acid Soils (RA3)
Clifftop	20	35-70	257-586	1052-1346	Mountains	Convex mountain slope	Acid fine-loamy residuum weathered from shale and siltstone	Very Rocky, Acid Soils (RA3)
LhE:								
Layland	60	15-35	229-589	1052-1346	Mountains	Mountain slope	Rubbly, acid colluvium derived from interbedded sedimentary rock	Very Rocky, Acid Soils (RA3)

Table 8.—Landscape, Parent Material, and West Virginia Grassland Suitability Class—Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	WV grassland suitability class name and number
	Pct	Pct	Meters	mm				
LhE:								
Laidig	25	15-35	229-589	1052-1346	Mountains	Mountain slope	Rubbly colluvium derived from interbedded sedimentary rock	Very Rocky, Acid Soils (RA3)
LkE:								
Layland	55	15-35	214-556	1052-1346	Mountains	Areas below rock outcrop on mountain slope	Very rubbly colluvium derived from sandstone and siltstone	Not Suited (NS)
Laidig	30	15-35	214-556	1052-1346	Mountains	Drainageway, footslope, and mountain slope	Very rubbly colluvium derived from interbedded sedimentary rock	Not Suited (NS)
LmF:								
Layland	60	35-70	212-600	1052-1346	Mountains	Areas below rock outcrop on mountain slope	Very rubbly colluvium derived from sandstone and siltstone	Not Suited (NS)
Rock outcrop	10	None assigned	212-600	1052-1346	Mountains	Sandstone escarpment	Sandstone	Not Suited (NS)
LuC:								
Lithic Udorthents, leveled land	85	0-15	301-377	1052-1346	Mountains	Drastically disturbed areas on mountain slope	Cut and fill materials derived from native soils and interbedded sedimentary rock	Not Suited (NS)
LxG:								
Lithic Udorthents, cut land	50	5-100	301-377	1052-1346	Mountains	Drastically disturbed areas on mountain slope	Cut and fill materials derived from native soils and interbedded sedimentary rock	Not Suited (NS)
Rock outcrop	40	None assigned	301-377	1052-1346	Mountains	Drastically disturbed areas on mountain slope	Interbedded sedimentary rock	Not Suited (NS)

Table 8.—Landscape, Parent Material, and West Virginia Grassland Suitability Class—Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	WV grassland suitability class name and number
	Pct	Pct	Meters	mm				
NaB:								
Nallen	80	3-8	523-528	1052-1346	Mountains	Ridge	Acid coarse-loamy residuum weathered from sandstone	Acid Loams (AL3)
NaC:								
Nallen	75	8-15	326-584	1052-1346	Mountains	Ridge	Acid coarse-loamy residuum weathered from sandstone	Acid Loams (AL3)
NaD:								
Nallen	75	15-25	297-569	1052-1346	Mountains	Ridge	Acid coarse-loamy residuum weathered from sandstone	Acid Loams (AL3)
PsA:								
Pope, rarely flooded	85	0-3	213-374	1052-1346	Mountains	Flood plain in river valley	Coarse-loamy alluvium derived from sandstone and shale	Acid Loams (AL3)
PvA:								
Pope, occasionally flooded	50	0-3	211-515	1052-1346	Mountains	Flood plain in river valley	Coarse-loamy alluvium derived from sandstone and shale	Acid Loams (AL3)
Craigsville, occasionally flooded	30	0-3	211-515	1052-1346	Mountains	Flood plain in river valley	Loamy-skeletal alluvium derived from sandstone and shale	Acid Loams (AL3)
Rw:								
Riverwash, frequently flooded	95	0-3	211-511	1052-1346	Mountains	Sand and cobble bars along the river on high-energy flood plain in river valley	Sandy and gravelly alluvium derived from interbedded sedimentary rock	Not Suited (NS)

Table 8.—Landscape, Parent Material, and West Virginia Grassland Suitability Class—Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	WV grassland suitability class name and number
	Pct	Pct	Meters	mm				
ThB:								
Typic Haplorthods, rarely flooded	80	0-8	412-418	1052-1346	Mountains	Island in river valley	Acid, stony alluvium derived from sandstone	Not Suited (NS)
UgC:								
Udorthents, graded	85	0-15	303-580	1052-1346	Mountains	None assigned	Cut and fill materials derived from native soils and interbedded sedimentary rock	Not Suited (NS)
UgF:								
Udorthents, graded	85	15-55	302-560	1052-1346	Mountains	None assigned	Cut and fill materials derived from native soils and interbedded sedimentary rock	Not Suited (NS)
Ur:								
Udorthents, railroad grade	93	0-70	215-518	1052-1346	Mountains	Railroad beds	Cut and fill materials derived from native soils and interbedded sedimentary rock	Not Suited (NS)
Uu:								
Udorthents, highways	70	0-7	533-571	1052-1346	Mountains	Road beds	Cut and fill materials derived from native soils and interbedded sedimentary rock	Not Suited (NS)
Urban land, highways	25	0-7	533-571	1052-1346	Mountains	None assigned	None assigned	Not Suited (NS)
W:								
Water	90	None assigned	211-511	1052-1346	Mountains	Rivers and ponds	None assigned	None assigned
Wr:								
Water	75	None assigned	339-488	1052-1346	Mountains	Rivers and ponds	None assigned	None assigned

Table 8.—Landscape, Parent Material, and West Virginia Grassland Suitability Class—Continued

Map unit symbol and soil name	Percent of map unit	Slope	Elevation	MAP	Landscape	Landform	Parent material	WV grassland suitability class name and number
	Pct	Pct	Meters	mm				
Wr:								
Rubble land, frequently flooded	25	None assigned	339-488	1052-1346	Mountains	Boulder and stone rock topple deposits along the river	Rock topple deposits derived from sandstone	Not Suited (NS)

Table 9.—Forest Productivity

(Characteristic trees are pulled from the National Soil Information System (NASIS) component forest productivity table. The site index base age indicates the age used for the site curves. The volume of wood fiber is the yield likely to be produced by the most important tree species at the age of culmination of the mean annual increment (CMAI). The volume is the amount of fiber produced in a fully stocked, even-aged, unmanaged stand. Only the soils suitable for forestland are listed)

Map unit symbol and soil name	Potential productivity			Volume of wood fiber (CMAI)
	Characteristic trees	Site index base age	Site index in feet	
		yrs		cu ft/ac/yr
AgC:				
Allegheny	black oak	50	78	60
	eastern white pine	50	90	166
	northern red oak	50	80	62
	yellow-poplar	50	90	90
BhG:				
Berks	black oak	50	70	52
	chestnut oak	50	70	52
	eastern white pine	50	82	148
	northern red oak	50	70	52
Highsplint	yellow-poplar	50	108	121
	northern red oak	50	86	68
Sharondale	yellow-poplar	50	116	133
	cucumbertree	50	101	109
	northern red oak	50	92	74
BuC:				
Buchanan	northern red oak	50	80	62
	yellow-poplar	50	90	90
ClB:				
Clifftop	northern red oak	50	75	57
	yellow-poplar	50	86	82
	white oak	50	67	49
ClC:				
Clifftop	northern red oak	50	75	57
	yellow-poplar	50	86	82
	white oak	50	67	49
ClD:				
Clifftop	northern red oak	50	75	57
	white oak	50	67	49
	yellow-poplar	50	86	82
ClE:				
Clifftop	yellow-poplar	50	86	82
	northern red oak	50	75	57
	white oak	50	67	49
CmC:				
Clifftop	northern red oak	50	75	57
	yellow-poplar	50	86	82
	white oak	50	67	49
CwB:				
Cottonbend	northern red oak	50	78	60
	tuliptree	50	88	86

Table 9.—Forest Productivity—Continued

Map unit symbol and soil name	Potential productivity: Characteristic trees	Site index base age	Site index in feet	Volume of wood fiber (CMAI)
		yrs		cu ft/ac/yr
CwC:				
Cottonbend	northern red oak	50	78	60
	tuliptree	50	88	86
DkC:				
Dekalb	scarlet oak	50	69	51
	northern red oak	50	65	47
	chestnut oak	50	60	43
DrE:				
Dekalb	scarlet oak	50	69	51
	northern red oak	50	65	47
	chestnut oak	50	60	43
FeB:				
Fenwick	black cherry	50	85	52
	northern red oak	50	75	57
	white ash	50	85	111
	yellow-poplar	50	90	90
FeC:				
Fenwick	black cherry	50	85	52
	northern red oak	50	75	57
	white ash	50	85	111
	yellow-poplar	50	90	90
HgE:				
Highsplint	yellow-poplar	50	108	121
	northern red oak	50	86	68
LaC:				
Laidig	yellow-poplar	50	90	90
	northern red oak	50	80	62
	white oak	50	80	62
LbC:				
Laidig	yellow-poplar	50	90	90
	northern red oak	50	80	62
	white oak	50	80	62
LcE:				
Laidig	northern red oak	50	80	62
	white oak	50	80	62
	yellow-poplar	50	90	90
Clifftop	yellow-poplar	50	86	82
	northern red oak	50	75	57
	white oak	50	67	49
LdF:				
Layland	yellow-poplar	50	100	107
	northern red oak	50	82	64
Clifftop	yellow-poplar	50	86	82
	northern red oak	50	75	57
	white oak	50	67	49

Table 9.—Forest Productivity—Continued

Map unit symbol and soil name	Potential productivity: Characteristic trees	Potential productivity: Site index base age	Potential productivity: Site index in feet	Volume of wood fiber (CMAI)
		yrs		cu ft/ac/yr
LhE:				
Layland	yellow-poplar	50	100	107
	northern red oak	50	82	64
Laidig	yellow-poplar	50	90	90
	northern red oak	50	80	62
	white oak	50	80	62
LkE:				
Layland	yellow-poplar	50	100	107
	northern red oak	50	82	64
Laidig	yellow-poplar	50	90	90
	northern red oak	50	80	62
	white oak	50	80	62
LmF:				
Layland	yellow-poplar	50	100	107
	northern red oak	50	82	64
NaB:				
Nallen	chestnut oak	50	67	49
	northern red oak	50	70	52
	scarlet oak	50	56	39
NaC:				
Nallen	chestnut oak	50	67	49
	northern red oak	50	70	52
	scarlet oak	50	56	39
NaD:				
Nallen	chestnut oak	50	67	49
	northern red oak	50	70	52
	scarlet oak	50	56	39
PsA:				
Pope, rarely flooded	yellow-poplar	50	96	100
	northern red oak	50	80	62
	white oak	50	80	62
PvA:				
Pope, occasionally flooded	yellow-poplar	50	96	100
	northern red oak	50	80	62
	white oak	50	80	62
Craigsville, occasionally flooded	eastern white pine	50	90	166
	northern red oak	50	75	57
	Virginia pine	50	80	114
	yellow-poplar	50	90	100
ThB:				
Typic Haplorthods, rarely flooded	northern red oak	50	65	47

Table 10.—Index of Common and Scientific Plant Names and Plant Symbols Sorted by Common Name

(Plants displayed occur within the National Soils Information System (NASIS) plant tables used for the soil survey area. The scientific and common names are referenced at the USDA PLANTS database: plants.usda.gov)

Local common name	Scientific name	Plant symbol
American basswood	Tilia americana	TIAM
American beech	Fagus grandifolia	FAGR
American chestnut	Castanea dentata	CADE12
American ginseng	Panax quinquefolius	PAQU
American holly	Ilex opaca	ILOP
American hornbeam	Carpinus caroliniana	CACA18
American sycamore	Platanus occidentalis	PLOC
American witchhazel	Hamamelis virginiana	HAVI4
autumn olive	laeagnus umbellata	ELUM
basswood	Tilia	TILIA
bitternut hickory	Carya cordiformis	CACO15
black cherry	Prunus serotina	PRSE2
black cohosh	Cimicifuga racemosa	CIRA
black locust	Robinia pseudoacacia	ROPS
black oak	Quercus velutina	QUVE
black walnut	Juglans nigra	JUNI
blackberry	Rubus	RUBUS
blackgum	yssa sylvatica	NYSY
blue cohosh	Caulophyllum thalictroides	CATH2
Blue Ridge blueberry	Vaccinium pallidum	VAPA4
blueberry	Vaccinium	VACCI
boxelder	Acer negundo	ACNE2
checkerberry wintergreen	Gaultheria procumbens	GAPR2
chestnut oak	Quercus prinus	QUPR2
Christmas fern	Polystichum acrostichoides	POAC4
common elderberry	Sambucus nigra ssp. canadensis	SANIC4
cucumbertree	Magnolia acuminata	MAAC
eastern cottonwood	Populus deltoides	PODE3
eastern hemlock	Tsuga canadensis	TSCA
eastern poison ivy	Toxicodendron radicans	TORA2
eastern redbud	Cercis canadensis	CECA4
eastern teaberry	Gaultheria procumbens	GAPR2
eastern white pine	Pinus strobus	PIST
flowering dogwood	Cornus florida	COFL2
grass		2GP
grass, perennial		2GP
green ash	Fraxinus pennsylvanica	FRPE
greenbrier	Smilax rotundifolia	SMRO
groundcedar	Lycopodium complanatum	LYCO3
hazel alder	Alnus serrulata	ALSE2
hickory	Carya	CARYA
huckleberry	Gaylussacia	GAYLU
Indianpipe	Monotropa	MONOT
lespedeza	Lespedeza	LESPE
Lichen, crustose		2LC
maidenfern	Adiantum pedatum	ADPE
mapleleaf viburnum	Viburnum acerifolium	VIAC
mayapple	Podophyllum peltatum	POPE
mockernut hickory	Carya alba	CAAL27
mountain laurel	Kalmia latifolia	KALA
mountain magnolia	Magnolia fraseri	MAFR
mountain maple	Acer spicatum	ACSP2
multiflora rose	Rosa multiflora	ROMU
navel lichen	Umbilicaria mammulata	UMMA60
New York fern	Thelypteris noveboracensis	THNO
northern red oak	Quercus rubra	QURU
perennial grasses	unknown scientific name	UNKNOWN
pignut hickory	Carya glabra	CAGL8
pin oak	Quercus palustris	QUPA2
pitch pine	Pinus rigida	PIRI

Table 10.—Index of Common and Scientific Plant Names and Plant Symbols
Sorted by Common Name—Continued

Local common name	Scientific name	Plant symbol
rattlesnake plantain	Goodyera	GOODY
red maple	Acer rubrum	ACRU
rhododendron	Rhododendron	RHODO
river birch	Betula nigra	BENI
riverbank grape	Vitis riparia	VIRI
sassafras	Sassafras albidum	SAAL5
scarlet oak	Quercus coccinea	QUCO2
shagbark hickory	Carya ovata	CAOV2
shellbark hickory	Carya laciniosa	CALA21
shortleaf pine	Pinus echinata	PIEC2
sourwood	Oxydendrum arboreum	OXAR
springbeauty	Claytonia	CLAYT
striped maple	Acer pensylvanicum	ACPE
sugar maple	Acer saccharum	ACSA3
sweet birch	Betula lenta	BELE
tall fescue	Lolium arundinaceum	LOAR10
tree of heaven	Ailanthus altissima	AIAL
trillium	Trillium	TRILL
tuliptree	Liriodendron tulipifera	LITU
umbrella magnolia	Magnolia tripetala	MATR
vetch	Vicia	VICIA
Virginia creeper	Parthenocissus quinquefolia	PAQU2
Virginia pine	Pinus virginiana	PIVI2
white ash	Fraxinus americana	FRAM2
white baneberry	Actaea pachypoda	ACPA
white oak	Quercus alba	QUAL
white snakeroot	Ageratina altissima	AGAL5
wild leek	Allium tricoccum	ALTR3
yellow buckeye	Aesculus flava	AEFL
yellow-poplar	Liriodendron tulipifera	LITU

Table 11.—Index of Common and Scientific Plant Names and Plant Symbols Sorted by Plant Symbol

(Plants displayed occur within the National Soils Information System (NASIS) plant tables used for the soil survey area. The scientific and common names are referenced at the USDA PLANTS database: plants.usda.gov)

Local common name	Scientific name	Plant symbol
grass		2GP
grass, perennial		2GP
Lichen, crustose		2LC
boxelder	Acer negundo	ACNE2
white baneberry	Actaea pachypoda	ACPA
striped maple	Acer pensylvanicum	ACPE
red maple	Acer rubrum	ACRU
sugar maple	Acer saccharum	ACSA3
mountain maple	Acer spicatum	ACSP2
maidenfern	Adiantum pedatum	ADPE
yellow buckeye	Aesculus flava	AEFL
white snakeroot	Ageratina altissima	AGAL5
tree of heaven	Ailanthus altissima	AIAL
hazel alder	Alnus serrulata	ALSE2
wild leek	Allium tricoccum	ALTR3
sweet birch	Betula lenta	BELE
river birch	Betula nigra	BENI
mockernut hickory	Carya alba	CAAL27
American hornbeam	Carpinus caroliniana	CACA18
bitternut hickory	Carya cordiformis	CACO15
American chestnut	Castanea dentata	CADE12
pignut hickory	Carya glabra	CAGL8
shellbark hickory	Carya laciniosa	CALA21
shagbark hickory	Carya ovata	CAOV2
hickory	Carya	CARYA
blue cohosh	Caulophyllum thalictroides	CATH2
eastern redbud	Cercis canadensis	CECA4
black cohosh	Cimicifuga racemosa	CIRA
springbeauty	Claytonia	CLAYT
flowering dogwood	Cornus florida	COFL2
autumn olive	Elaeagnus umbellata	ELUM
American beech	Fagus grandifolia	FAGR
white ash	Fraxinus americana	FRAM2
green ash	Fraxinus pennsylvanica	FRPE
checkerberry wintergreen	Gaultheria procumbens	GAPR2
eastern teaberry	Gaultheria procumbens	GAPR2
huckleberry	Gaylussacia	GAYLU
rattlesnake plantain	Goodyera	GOODY
American witchhazel	Hamamelis virginiana	HAVI4
American holly	Ilex opaca	ILOP
black walnut	Juglans nigra	JUNI
mountain laurel	Kalmia latifolia	KALA
lespedeza	Lespedeza	LESPE
tuliptree	Liriodendron tulipifera	LITU
yellow-poplar	Liriodendron tulipifera	LITU
tall fescue	Lolium arundinaceum	LOAR10
groundcedar	Lycopodium complanatum	LYCO3
cucumbertree	Magnolia acuminata	MAAC
mountain magnolia	Magnolia fraseri	MAFR
umbrella magnolia	Magnolia tripetala	MATR
Indianpipe	Monotropa	MONOT
blackgum	Nyssa sylvatica	NYSY
sourwood	Oxydendrum arboreum	OXAR
American ginseng	Panax quinquefolius	PAQU
Virginia creeper	Parthenocissus quinquefolia	PAQU2
shortleaf pine	Pinus echinata	PIEC2
pitch pine	Pinus rigida	PIRI
eastern white pine	Pinus strobus	PIST
Virginia pine	Pinus virginiana	PIVI2
American sycamore	Platanus occidentalis	PLOC

Table 11.—Index of Common and Scientific Plant Names and Plant Symbols Sorted by Plant Symbol—Continued

Local common name	Scientific name	Plant symbol
Christmas fern	Polystichum acrostichoides	POAC4
eastern cottonwood	Populus deltoides	PODE3
mayapple	Podophyllum peltatum	POPE
black cherry	Prunus serotina	PRSE2
white oak	Quercus alba	QUAL
scarlet oak	Quercus coccinea	QUCO2
pin oak	Quercus palustris	QUPA2
chestnut oak	Quercus prinus	QUPR2
northern red oak	Quercus rubra	QURU
black oak	Quercus velutina	QUVE
rhododendron	Rhododendron	RHODO
multiflora rose	Rosa multiflora	ROMU
black locust	Robinia pseudoacacia	ROPS
blackberry	Rubus	RUBUS
sassafras	Sassafras albidum	SAAL5
common elderberry	Sambucus nigra ssp. canadensis	SANIC4
greenbrier	Smilax rotundifolia	SMRO
New York fern	Thelypteris noveboracensis	THNO
American basswood	Tilia americana	TIAM
basswood	Tilia	TILIA
eastern poison ivy	Toxicodendron radicans	TORA2
trillium	Trillium	TRILL
eastern hemlock	Tsuga canadensis	TSCA
navel lichen	Umbilicaria mammulata	UMMA60
perennial grasses	unknown scientific name	UNKNOWN
blueberry	Vaccinium	VACCI
Blue Ridge blueberry	Vaccinium pallidum	VAPA4
mapleleaf viburnum	Viburnum acerifolium	VIAC
vetch	Vicia	VICIA
riverbank grape	Vitis riparia	VIRI

Table 12.—Land Management, Part I (Planting)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Suitability for hand planting: Rating class and limiting features	Value	Suitability for mechanical planting: Rating class and limiting features	Value	Soil rutting hazard: Rating class and limiting features	Value
AgC:							
Allegheny	80	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
BhG:							
Berks	35	Moderately suited		Unsuited		Slight	
		Slope	0.50	Slope	1.00	Strength	0.10
				Rock fragments	0.50		
Highsplint	30	Moderately suited		Unsuited		Slight	
		Slope	0.50	Slope	1.00	Strength	0.10
				Rock fragments	0.50		
Sharondale	20	Moderately suited		Unsuited		Slight	
		Slope	0.50	Slope	1.00	Strength	0.10
				Rock fragments	0.50		
BuC:							
Buchanan	80	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
				Rock fragments	0.50		
ClB:							
Clifftop	80	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
ClC:							
Clifftop	80	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
ClD:							
Clifftop	75	Well suited		Poorly suited		Severe	
				Slope	0.75	Low strength	1.00
ClE:							
Clifftop	70	Well suited		Unsuited		Severe	
				Slope	1.00	Low strength	1.00
CmC:							
Clifftop	75	Well suited		Moderately suited		Severe	
				Rock fragments	0.50	Low strength	1.00
				Slope	0.50		
CwB:							
Cottonbend	90	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
CwC:							
Cottonbend	90	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
DkC:							
Dekalb	80	Moderately suited		Poorly suited		Moderate	
		Rock fragments	0.50	Rock fragments	0.75	Low strength	0.50
				Slope	0.50		

Table 12.—Land Management, Part I (Planting)—Continued

Map unit symbol and soil name	Pct. of map unit	Suitability for hand planting: Rating class and limiting features	Value	Suitability for mechanical planting: Rating class and limiting features	Value	Soil rutting hazard: Rating class and limiting features	Value
DrE:							
Dekalb	55	Moderately suited		Poorly suited		Moderate	
		Rock fragments	0.50	Slope	0.75	Low strength	0.50
				Rock fragments	0.75		
Rock outcrop	15	Not rated		Not rated		Not rated	
FeB:							
Fenwick	85	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
FeC:							
Fenwick	85	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
HgE:							
Highsplint	70	Well suited		Poorly suited		Slight	
				Slope	0.75	Strength	0.10
				Rock fragments	0.50		
LaC:							
Laidig	70	Poorly suited		Unsuited		Moderate	
		Rock fragments	0.75	Rock fragments	1.00	Low strength	0.50
				Slope	0.50		
LbC:							
Laidig	75	Unsuited		Unsuited		Moderate	
		Rock fragments	1.00	Rock fragments	1.00	Low strength	0.50
				Slope	0.50		
LcE:							
Laidig	45	Well suited		Poorly suited		Moderate	
				Slope	0.75	Low strength	0.50
				Rock fragments	0.50		
Clifftop	25	Well suited		Poorly suited		Severe	
				Slope	0.75	Low strength	1.00
				Rock fragments	0.50		
LdF:							
Layland	60	Moderately suited		Unsuited		Moderate	
		Slope	0.50	Slope	1.00	Low strength	0.50
				Rock fragments	0.50		
Clifftop	20	Moderately suited		Unsuited		Severe	
		Slope	0.50	Slope	1.00	Low strength	1.00
				Rock fragments	0.50		
LhE:							
Layland	60	Poorly suited		Unsuited		Moderate	
		Rock fragments	0.75	Rock fragments	1.00	Low strength	0.50
				Slope	0.75		
Laidig	25	Poorly suited		Unsuited		Moderate	
		Rock fragments	0.75	Rock fragments	1.00	Low strength	0.50
				Slope	0.75		

Table 12.—Land Management, Part I (Planting)—Continued

Map unit symbol and soil name	Pct. of map unit	Suitability for hand planting: Rating class and limiting features	Value	Suitability for mechanical planting: Rating class and limiting features	Value	Soil rutting hazard: Rating class and limiting features	Value
LkE:							
Layland	55	Unsuited		Unsuited		Moderate	
		Rock fragments	1.00	Rock fragments	1.00	Low strength	0.50
				Slope	0.75		
Laidig	30	Unsuited		Unsuited		Moderate	
		Rock fragments	1.00	Rock fragments	1.00	Low strength	0.50
				Slope	0.75		
LmF:							
Layland	60	Unsuited		Unsuited		Moderate	
		Rock fragments	1.00	Slope	1.00	Low strength	0.50
		Slope	0.50	Rock fragments	1.00		
Rock outcrop	10	Not rated		Not rated		Not rated	
LuC:							
Lithic Udorthents, leveled land	85	Not rated		Not rated		Not rated	
LxG:							
Lithic Udorthents, cut land	50	Not rated		Not rated		Not rated	
Rock outcrop	40	Not rated		Not rated		Not rated	
NaB:							
Nallen	80	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
NaC:							
Nallen	75	Well suited		Moderately suited		Severe	
				Slope	0.50	Low strength	1.00
NaD:							
Nallen	75	Well suited		Poorly suited		Severe	
				Slope	0.75	Low strength	1.00
PsA:							
Pope, rarely flooded	85	Well suited		Well suited		Moderate	
						Low strength	0.50
PvA:							
Pope, occasionally flooded	50	Well suited		Well suited		Moderate	
						Low strength	0.50
Craigsville, occasionally flooded	30	Well suited		Moderately suited		Moderate	
				Rock fragments	0.50	Low strength	0.50
Rw:							
Riverwash, frequently flooded	95	Not rated		Not rated		Not rated	
ThB:							
Typic Haplorthods, rarely flooded	80	Poorly suited		Unsuited		Moderate	
		Rock fragments	0.75	Rock fragments	1.00	Low strength	0.50

Table 12.—Land Management, Part I (Planting)—Continued

Map unit symbol and soil name	Pct. of map unit	Suitability for hand planting: Rating class and limiting features	Value	Suitability for mechanical planting: Rating class and limiting features	Value	Soil rutting hazard: Rating class and limiting features	Value
UgC:							
Udorthents, graded	85	Not rated		Not rated		Not rated	
UgF:							
Udorthents, graded	85	Not rated		Not rated		Not rated	
Ur:							
Udorthents, railroad grade	93	Not rated		Not rated		Not rated	
Uu:							
Udorthents, highways	70	Not rated		Not rated		Not rated	
Urban land, highways	25	Not rated		Not rated		Not rated	
W:							
Water	100	Not rated		Not rated		Not rated	
Wr:							
Water	75	Not rated		Not rated		Not rated	
Rubble land, frequently flooded	25	Not rated		Not rated		Not rated	

Table 12.—Land Management, Part II (Hazard of Erosion and Suitability for Roads)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Hazard of erosion: Rating class and limiting features	Value	Hazard of erosion on roads and trails: Rating class and limiting features	Value	Suitability for roads (natural surface): Rating class and limiting features	Value
AgC:							
Allegheny-----------	80	Moderate		Severe		Moderately suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	0.50
						Low strength	0.50
						Landslides	0.07
BhG:							
Berks---------------	35	Very severe		Severe		Poorly suited	
		Slope/erodibility	0.95	Slope/erodibility	0.95	Slope	1.00
						Landslides	1.00
Highsplint----------	30	Very severe		Severe		Poorly suited	
		Slope/erodibility	0.95	Slope/erodibility	0.95	Slope	1.00
						Landslides	1.00
Sharondale----------	20	Very severe		Severe		Poorly suited	
		Slope/erodibility	0.95	Slope/erodibility	0.95	Slope	1.00
						Landslides	1.00
BuC:							
Buchanan------------	80	Slight		Severe		Moderately suited	
				Slope/erodibility	0.95	Slope	0.50
						Low strength	0.50
						Wetness	0.50
						Landslides	0.21
ClB:							
Clifftop------------	80	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Low strength	0.50
						Landslides	0.01
ClC:							
Clifftop------------	80	Moderate		Severe		Moderately suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	0.50
						Low strength	0.50
						Landslides	0.07
ClD:							
Clifftop------------	75	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Low strength	0.50
						Landslides	0.15
ClE:							
Clifftop------------	70	Severe		Severe		Poorly suited	
		Slope/erodibility	0.75	Slope/erodibility	0.95	Slope	1.00
						Landslides	0.60
						Low strength	0.50
CmC:							
Clifftop------------	75	Slight		Severe		Moderately suited	
				Slope/erodibility	0.95	Slope	0.50
						Low strength	0.50
						Landslides	0.04

Table 12.—Land Management, Part II (Hazard of Erosion and Suitability for Roads)—Continued

Map unit symbol and soil name	Pct. of map unit	Hazard of erosion: Rating class and limiting features	Value	Hazard of erosion on roads and trails: Rating class and limiting features	Value	Suitability for roads (natural surface): Rating class and limiting features	Value
CwB:							
Cottonbend	90	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Low strength	0.50
CwC:							
Cottonbend	90	Moderate		Severe		Moderately suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	0.50
						Low strength	0.50
						Landslides	0.07
DkC:							
Dekalb	80	Slight		Slight		Moderately suited	
						Slope	0.50
						Rock fragments	0.50
						Landslides	0.04
DrE:							
Dekalb	55	Moderate		Moderate		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.50	Slope	1.00
						Landslides	0.60
						Rock fragments	0.50
Rock outcrop	15	Not rated		Not rated		Not rated	
FeB:							
Fenwick	85	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Low strength	0.50
						Slope	0.50
						Wetness	0.50
						Landslides	0.01
FeC:							
Fenwick	85	Slight		Severe		Moderately suited	
				Slope/erodibility	0.95	Slope	0.50
						Low strength	0.50
						Wetness	0.50
						Landslides	0.21
HgE:							
Highsplint	70	Moderate		Moderate		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.50	Slope	1.00
						Landslides	1.00
LaC:							
Laidig	70	Slight		Moderate		Poorly suited	
				Slope/erodibility	0.50	Rock fragments	1.00
						Slope	0.50
						Low strength	0.50
						Landslides	0.12
LbC:							
Laidig	75	Slight		Moderate		Poorly suited	
				Slope/erodibility	0.50	Rock fragments	1.00
						Slope	0.50
						Low strength	0.50
						Landslides	0.21

Table 12.—Land Management, Part II (Hazard of Erosion and Suitability for Roads)—Continued

Map unit symbol and soil name	Pct. of map unit	Hazard of erosion: Rating class and limiting features	Value	Hazard of erosion on roads and trails: Rating class and limiting features	Value	Suitability for roads (natural surface): Rating class and limiting features	Value
LcE:							
Laidig	45	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Landslides	1.00
						Low strength	0.50
Clifftop	25	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Landslides	0.60
						Low strength	0.50
LdF:							
Layland	60	Severe		Severe		Poorly suited	
		Slope/erodibility	0.75	Slope/erodibility	0.95	Slope	1.00
						Landslides	1.00
Clifftop	20	Very severe		Severe		Poorly suited	
		Slope/erodibility	0.95	Slope/erodibility	0.95	Slope	1.00
						Landslides	1.00
						Low strength	0.50
LhE:							
Layland	60	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Rock fragments	1.00
						Landslides	1.00
Laidig	25	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Rock fragments	1.00
						Landslides	1.00
						Low strength	0.50
LkE:							
Layland	55	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Rock fragments	1.00
						Landslides	0.60
Laidig	30	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Rock fragments	1.00
						Landslides	1.00
						Low strength	0.50
LmF:							
Layland	60	Very severe		Severe		Poorly suited	
		Slope/erodibility	0.95	Slope/erodibility	0.95	Slope	1.00
						Rock fragments	1.00
						Landslides	1.00
Rock outcrop	10	Not rated		Not rated		Not rated	
LuC:							
Lithic Udorthents, leveled land	85	Not rated		Not rated		Not rated	

Table 12.—Land Management, Part II (Hazard of Erosion and Suitability for Roads)—Continued

Map unit symbol and soil name	Pct. of map unit	Hazard of erosion: Rating class and limiting features	Value	Hazard of erosion on roads and trails: Rating class and limiting features	Value	Suitability for roads (natural surface): Rating class and limiting features	Value
LxG:							
Lithic Udorthents, cut land	50	Not rated		Not rated		Not rated	
Rock outcrop	40	Not rated		Not rated		Not rated	
NaB:							
Nallen	80	Slight		Moderate		Moderately suited	
				Slope/erodibility	0.50	Low strength	0.50
						Slope	0.50
						Landslides	0.01
NaC:							
Nallen	75	Slight		Severe		Moderately suited	
				Slope/erodibility	0.95	Slope	0.50
						Low strength	0.50
						Landslides	0.07
NaD:							
Nallen	75	Moderate		Severe		Poorly suited	
		Slope/erodibility	0.50	Slope/erodibility	0.95	Slope	1.00
						Low strength	0.50
						Landslides	0.15
PsA:							
Pope, rarely flooded	85	Slight		Slight		Well suited	
PvA:							
Pope, occasionally flooded	50	Slight		Slight		Poorly suited	
						Flooding	1.00
Craigsville, occasionally flooded	30	Slight		Slight		Poorly suited	
						Flooding	1.00
Rw:							
Riverwash, frequently flooded	95	Not rated		Not rated		Not rated	
ThB:							
Typic Haplorthods, rarely flooded	80	Slight		Slight		Poorly suited	
						Rock fragments	1.00
UgC:							
Udorthents, graded	85	Not rated		Not rated		Not rated	
UgF:							
Udorthents, graded	85	Not rated		Not rated		Not rated	
Ur:							
Udorthents, railroad grade	93	Not rated		Not rated		Not rated	
Uu:							
Udorthents, highways	70	Not rated		Not rated		Not rated	
Urban land, highways	25	Not rated		Not rated		Not rated	

Table 12.—Land Management, Part II (Hazard of Erosion and Suitability for Roads)—Continued

Map unit symbol and soil name	Pct. of map unit	Hazard of erosion: Rating class and limiting features	Hazard of erosion: Value	Hazard of erosion on roads and trails: Rating class and limiting features	Hazard of erosion on roads and trails: Value	Suitability for roads (natural surface): Rating class and limiting features	Suitability for roads (natural surface): Value
W:							
Water	100	Not rated		Not rated		Not rated	
Wr:							
Water	75	Not rated		Not rated		Not rated	
Rubble land, frequently flooded	25	Not rated		Not rated		Not rated	

Table 12.—Land Management, Part III (Site Preparation)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Suitability for mechanical site preparation (deep): Rating class and limiting features	Value	Suitability for mechanical site preparation (surface): Rating class and limiting features	Value
AgC:					
Allegheny	80	Well suited		Well suited	
BhG:					
Berks	35	Unsuited		Unsuited	
		Slope	1.00	Slope	1.00
Highsplint	30	Unsuited		Unsuited	
		Slope	1.00	Slope	1.00
Sharondale	20	Unsuited		Unsuited	
		Slope	1.00	Slope	1.00
BuC:					
Buchanan	80	Well suited		Well suited	
ClB:					
Clifftop	80	Well suited		Well suited	
ClC:					
Clifftop	80	Well suited		Well suited	
ClD:					
Clifftop	75	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
ClE:					
Clifftop	70	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
CmC:					
Clifftop	75	Well suited		Well suited	
CwB:					
Cottonbend	90	Well suited		Well suited	
CwC:					
Cottonbend	90	Well suited		Well suited	
DkC:					
Dekalb	80	Poorly suited		Poorly suited	
		Restrictive layer	0.50	Rock fragments	0.50
		Rock fragments	0.50		
DrE:					
Dekalb	55	Poorly suited		Poorly suited	
		Restrictive layer	0.50	Slope	0.50
		Slope	0.50	Rock fragments	0.50
		Rock fragments	0.50		
Rock outcrop	15	Not rated		Not rated	
FeB:					
Fenwick	85	Well suited		Well suited	

Table 12.—Land Management, Part III (Site Preparation)—Continued

Map unit symbol and soil name	Pct. of map unit	Suitability for mechanical site preparation (deep): Rating class and limiting features	Value	Suitability for mechanical site preparation (surface): Rating class and limiting features	Value
FeC:					
Fenwick	85	Well suited		Well suited	
HgE:					
Highsplint	70	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
LaC:					
Laidig	70	Unsuited		Unsuited	
		Rock fragments	1.00	Rock fragments	1.00
LbC:					
Laidig	75	Unsuited		Unsuited	
		Rock fragments	1.00	Rock fragments	1.00
LcE:					
Laidig	45	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
Clifftop	25	Poorly suited		Poorly suited	
		Slope	0.50	Slope	0.50
LdF:					
Layland	60	Unsuited		Unsuited	
		Slope	1.00	Slope	1.00
Clifftop	20	Unsuited		Unsuited	
		Slope	1.00	Slope	1.00
LhE:					
Layland	60	Unsuited		Unsuited	
		Rock fragments	1.00	Rock fragments	1.00
		Slope	0.50	Slope	0.50
Laidig	25	Unsuited		Unsuited	
		Rock fragments	1.00	Rock fragments	1.00
		Slope	0.50	Slope	0.50
LkE:					
Layland	55	Unsuited		Unsuited	
		Rock fragments	1.00	Rock fragments	1.00
		Slope	0.50	Slope	0.50
Laidig	30	Unsuited		Unsuited	
		Rock fragments	1.00	Rock fragments	1.00
		Slope	0.50	Slope	0.50
LmF:					
Layland	60	Unsuited		Unsuited	
		Rock fragments	1.00	Rock fragments	1.00
		Slope	1.00	Slope	1.00
Rock outcrop	10	Not rated		Not rated	
LuC:					
Lithic Udorthents, leveled land	85	Not rated		Not rated	
LxG:					
Lithic Udorthents, cut land	50	Not rated		Not rated	
Rock outcrop	40	Not rated		Not rated	

Table 12.—Land Management, Part III (Site Preparation)—Continued

Map unit symbol and soil name	Pct. of map unit	Suitability for mechanical site preparation (deep)		Suitability for mechanical site preparation (surface)	
		Rating class and limiting features	Value	Rating class and limiting features	Value
NaB:					
Nallen	80	Poorly suited		Well suited	
		Restrictive layer	0.50		
NaC:					
Nallen	75	Poorly suited		Well suited	
		Restrictive layer	0.50		
NaD:					
Nallen	75	Poorly suited		Poorly suited	
		Restrictive layer	0.50	Slope	0.50
		Slope	0.50		
PsA:					
Pope, rarely flooded	85	Well suited		Well suited	
PvA:					
Pope, occasionally flooded	50	Well suited		Well suited	
Craigsville, occasionally flooded	30	Well suited		Well suited	
Rw:					
Riverwash, frequently flooded	95	Not rated		Not rated	
ThB:					
Typic Haplorthods, rarely flooded	80	Unsuited		Unsuited	
		Rock fragments	1.00	Rock fragments	1.00
UgC:					
Udorthents, graded	85	Not rated		Not rated	
UgF:					
Udorthents, graded	85	Not rated		Not rated	
Ur:					
Udorthents, railroad grade	93	Not rated		Not rated	
Uu:					
Udorthents, highways	70	Not rated		Not rated	
Urban land, highways	25	Not rated		Not rated	
W:					
Water	100	Not rated		Not rated	
Wr:					
Water	75	Not rated		Not rated	
Rubble land, frequently flooded	25	Not rated		Not rated	

Table 12.—Land Management, Part IV (Site Restoration)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
AgC:					
Allegheny	80	Low		Moderate	
		Texture/rock fragments	0.10	Soil reaction	0.50
BhG:					
Berks	35	Low		Moderate	
				Available water	0.50
Highsplint	30	Low		Moderate	
				Available water	0.50
Sharondale	20	Low		Low	
		Texture/rock fragments	0.10		
BuC:					
Buchanan	80	Low		Moderate	
		Texture/rock fragments	0.10	Soil reaction	0.50
ClB:					
Clifftop	80	Moderate		Low	
		Texture/surface depth/rock fragments	0.50		
ClC:					
Clifftop	80	Moderate		Low	
		Texture/surface depth/rock fragments	0.50		
ClD:					
Clifftop	75	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Available water	0.50
ClE:					
Clifftop	70	Moderate		Moderate	
		Texture/slope/surface depth/rock fragments	0.50	Available water	0.50
CmC:					
Clifftop	75	Moderate		Low	
		Texture/surface depth/rock fragments	0.50		

Table 12.—Land Management, Part IV (Site Restoration)—Continued

Map unit symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
CwB:					
Cottonbend	90	Moderate		Low	
		Texture/surface depth/rock fragments	0.50		
CwC:					
Cottonbend	90	Moderate		Low	
		Texture/surface depth/rock fragments	0.50		
DkC:					
Dekalb	80	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Soil reaction	0.50
DrE:					
Dekalb	55	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Soil reaction	0.50
				Available water	0.50
Rock outcrop	15	Not rated		Not rated	
FeB:					
Fenwick	85	Moderate		High	
		Texture/surface depth/rock fragments	0.50	Wetness	1.00
				Soil reaction	0.50
FeC:					
Fenwick	85	Moderate		High	
		Texture/surface depth/rock fragments	0.50	Wetness	1.00
				Soil reaction	0.50
HgE:					
Highsplint	70	Low		Moderate	
		Texture/rock fragments	0.10	Available water	0.50
LaC:					
Laidig	70	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Soil reaction	0.50
LbC:					
Laidig	75	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Soil reaction	0.50
LcE:					
Laidig	45	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Soil reaction	0.50
				Available water	0.50

Table 12.—Land Management, Part IV (Site Restoration)—Continued

Map unit symbol and soil name	Pct. of map unit	Potential for damage to soil by fire		Potential for seedling mortality	
		Rating class and limiting features	Value	Rating class and limiting features	Value
LcE:					
Clifftop------------	25	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Available water	0.50
LdF:					
Layland-------------	60	Moderate		Moderate	
		Texture/slope/ surface depth/ rock fragments	0.50	Available water	0.50
				Soil reaction	0.50
Clifftop------------	20	Moderate		Moderate	
		Texture/slope/ surface depth/ rock fragments	0.50	Available water	0.50
LhE:					
Layland-------------	60	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Soil reaction	0.50
				Available water	0.50
Laidig--------------	25	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Soil reaction	0.50
				Available water	0.50
LkE:					
Layland-------------	55	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Soil reaction	0.50
				Available water	0.50
Laidig--------------	30	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Soil reaction	0.50
				Available water	0.50
LmF:					
Layland-------------	60	Moderate		Moderate	
		Texture/slope/ surface depth/ rock fragments	0.50	Available water	0.50
				Soil reaction	0.50
Rock outcrop--------	10	Not rated		Not rated	
LuC:					
Lithic Udorthents, leveled land-------	85	Not rated		Not rated	
LxG:					
Lithic Udorthents, cut land-----------	50	Not rated		Not rated	
Rock outcrop--------	40	Not rated		Not rated	
NaB:					
Nallen--------------	80	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Soil reaction	0.50

Table 12.—Land Management, Part IV (Site Restoration)—Continued

Map unit symbol and soil name	Pct. of map unit	Potential for damage to soil by fire: Rating class and limiting features	Value	Potential for seedling mortality: Rating class and limiting features	Value
NaC:					
Nallen	75	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Soil reaction	0.50
NaD:					
Nallen	75	Moderate		Moderate	
		Texture/surface depth/rock fragments	0.50	Soil reaction	0.50
				Available water	0.50
PsA:					
Pope, rarely flooded	85	Low		High	
		Texture/rock fragments	0.10	Wetness	1.00
				Soil reaction	0.50
PvA:					
Pope, occasionally flooded	50	Low		High	
		Texture/rock fragments	0.10	Wetness	1.00
				Soil reaction	0.50
Craigsville, occasionally flooded	30	Moderate		High	
		Texture/rock fragments	0.50	Wetness	1.00
				Soil reaction	0.50
Rw:					
Riverwash, frequently flooded	95	Not rated		Not rated	
ThB:					
Typic Haplorthods, rarely flooded	80	Moderate		High	
		Texture/surface depth/rock fragments	0.50	Wetness	1.00
				Soil reaction	0.50
UgC:					
Udorthents, graded	85	Not rated		Not rated	
UgF:					
Udorthents, graded	85	Not rated		Not rated	
Ur:					
Udorthents, railroad grade	93	Not rated		Not rated	
Uu:					
Udorthents, highways	70	Not rated		Not rated	
Urban land, highways	25	Not rated		Not rated	
W:					
Water	100	Not rated		Not rated	
Wr:					
Water	75	Not rated		Not rated	
Rubble land, frequently flooded	25	Not rated		Not rated	

Table 13.—Recreation, Part I (Camp and Picnic Areas)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value
AgC:					
Allegheny	80	Somewhat limited		Somewhat limited	
		Slope	0.63	Slope	0.63
BhG:					
Berks	35	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Large stones content	0.47	Large stones content	0.47
Highsplint	30	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Large stones content	0.47	Large stones content	0.47
Sharondale	20	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Large stones content	0.47	Large stones content	0.47
BuC:					
Buchanan	80	Somewhat limited		Somewhat limited	
		Slope	0.63	Slope	0.63
		Depth to saturated zone	0.39	Depth to saturated zone	0.19
ClB:					
Clifftop	80	Not limited		Not limited	
ClC:					
Clifftop	80	Somewhat limited		Somewhat limited	
		Slope	0.63	Slope	0.63
ClD:					
Clifftop	75	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
ClE:					
Clifftop	70	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
CmC:					
Clifftop	75	Somewhat limited		Somewhat limited	
		Large stones content	0.47	Large stones content	0.47
		Slope	0.04	Slope	0.04
CwB:					
Cottonbend	90	Not limited		Not limited	
CwC:					
Cottonbend	90	Somewhat limited	0.63	Somewhat limited	0.63
		Slope		Slope	

Table 13.—Recreation, Part I (Camp and Picnic Areas)—Continued

Map unit symbol and soil name	Pct. of map unit	Camp areas		Picnic areas	
		Rating class and limiting features	Value	Rating class and limiting features	Value
DkC:					
Dekalb	80	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	0.04	Slope	0.04
DrE:					
Dekalb	55	Very limited		Very limited	
		Too steep	1.00	Large stones content	1.00
		Large stones content	1.00	Too steep	1.00
Rock outcrop	15	Not rated		Not rated	
FeB:					
Fenwick	85	Somewhat limited		Somewhat limited	
		Depth to saturated zone	0.95	Depth to saturated zone	0.68
		Slow water movement	0.26	Slow water movement	0.26
FeC:					
Fenwick	85	Somewhat limited		Somewhat limited	
		Depth to saturated zone	0.95	Depth to saturated zone	0.68
		Slope	0.63	Slope	0.63
		Slow water movement	0.26	Slow water movement	0.26
HgE:					
Highsplint	70	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Large stones content	0.47	Large stones content	0.47
LaC:					
Laidig	70	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	0.04	Slope	0.04
LbC:					
Laidig	75	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	0.63	Slope	0.63
LcE:					
Laidig	45	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Large stones content	0.47	Large stones content	0.47
Clifftop	25	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Large stones content	0.47	Large stones content	0.47

Table 13.—Recreation, Part I (Camp and Picnic Areas)—Continued

Map unit symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value
LdF:					
Layland	60	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Large stones content	0.47	Large stones content	0.47
Clifftop	20	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00
		Large stones content	0.47	Large stones content	0.47
LhE:					
Layland	60	Very limited		Very limited	
		Too steep	1.00	Large stones content	1.00
		Large stones content	1.00	Too steep	1.00
Laidig	25	Very limited		Very limited	
		Too steep	1.00	Large stones content	1.00
		Large stones content	1.00	Too steep	1.00
LkE:					
Layland	55	Very limited		Very limited	
		Too steep	1.00	Large stones content	1.00
		Large stones content	1.00	Too steep	1.00
Laidig	30	Very limited		Very limited	
		Too steep	1.00	Large stones content	1.00
		Large stones content	1.00	Too steep	1.00
LmF:					
Layland	60	Very limited		Very limited	
		Too steep	1.00	Large stones content	1.00
		Large stones content	1.00	Too steep	1.00
Rock outcrop	10	Not rated		Not rated	
LuC:					
Lithic Udorthents, leveled land	85	Not rated		Not rated	
LxG:					
Lithic Udorthents, cut land	50	Not rated		Not rated	
Rock outcrop	40	Not rated		Not rated	
NaB:					
Nallen	80	Not limited		Not limited	
NaC:					
Nallen	75	Somewhat limited		Somewhat limited	
		Slope	0.63	Slope	0.63
NaD:					
Nallen	75	Very limited		Very limited	
		Too steep	1.00	Too steep	1.00

Table 13.—Recreation, Part I (Camp and Picnic Areas)—Continued

Map unit symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value
PsA:					
Pope, rarely flooded	85	Very limited		Not limited	
		Flooding	1.00		
PvA:					
Pope, occasionally flooded	50	Very limited		Not limited	
		Flooding	1.00		
Craigsville, occasionally flooded	30	Very limited		Not limited	
		Flooding	1.00		
Rw:					
Riverwash, frequently flooded	95	Not rated		Not rated	
ThB:					
Typic Haplorthods, rarely flooded	80	Very limited		Very limited	
		Flooding	1.00	Large stones content	1.00
		Large stones content	1.00		
UgC:					
Udorthents, graded	85	Not rated		Not rated	
UgF:					
Udorthents, graded	85	Not rated		Not rated	
Ur:					
Udorthents, railroad grade	93	Not rated		Not rated	
Uu:					
Udorthents, highways	70	Not rated		Not rated	
Urban land, highways	25	Not rated		Not rated	
W:					
Water	100	Not rated		Not rated	
Wr:					
Water	75	Not rated		Not rated	
Rubble land, frequently flooded	25	Not rated		Not rated	

Table 13.—Recreation, Part II (Trail Management)

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Value
AgC:					
Allegheny	80	Very limited		Very limited	
		Water erosion	1.00	Water erosion	1.00
BhG:					
Berks	35	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Large stones content	0.47	Large stones content	0.47
Highsplint	30	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Large stones content	0.47	Large stones content	0.47
Sharondale	20	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Large stones content	0.47	Large stones content	0.47
BuC:					
Buchanan	80	Not limited		Not limited	
ClB:					
Clifftop	80	Not limited		Not limited	
ClC:					
Clifftop	80	Not limited		Not limited	
ClD:					
Clifftop	75	Somewhat limited		Not limited	
		Slope	0.50		
ClE:					
Clifftop	70	Very limited		Somewhat limited	
		Slope	1.00	Slope	0.22
CmC:					
Clifftop	75	Somewhat limited		Somewhat limited	
		Large stones content	0.47	Large stones content	0.47
CwB:					
Cottonbend	90	Not limited		Not limited	
CwC:					
Cottonbend	90	Very limited	1.00	Very limited	1.00
		Water erosion		Water erosion	
DkC:					
Dekalb	80	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00

Table 13.—Recreation, Part II (Trail Management)—Continued

Map unit symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Value
DrE:					
Dekalb	55	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	1.00		
Rock outcrop	15	Not rated		Not rated	
FeB:					
Fenwick	85	Somewhat limited		Somewhat limited	
		Depth to saturated zone	0.32	Depth to saturated zone	0.32
FeC:					
Fenwick	85	Very limited		Very limited	
		Water erosion	1.00	Water erosion	1.00
		Depth to saturated zone	0.32	Depth to saturated zone	0.32
HgE:					
Highsplint	70	Very limited		Somewhat limited	
		Slope	1.00	Large stones content	0.47
		Large stones content	0.47		
LaC:					
Laidig	70	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
LbC:					
Laidig	75	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
LcE:					
Laidig	45	Very limited		Somewhat limited	
		Slope	1.00	Large stones content	0.47
		Large stones content	0.47		
Clifftop	25	Very limited		Somewhat limited	
		Slope	1.00	Large stones content	0.47
		Large stones content	0.47		
LdF:					
Layland	60	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Large stones content	0.47	Large stones content	0.47
Clifftop	20	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Large stones content	0.47	Large stones content	0.47

Table 13.—Recreation, Part II (Trail Management)—Continued

Map unit symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Value
LhE:					
Layland	60	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	1.00		
Laidig	25	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	1.00		
LkE:					
Layland	55	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	1.00		
Laidig	30	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	1.00		
LmF:					
Layland	60	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
		Slope	1.00	Slope	1.00
Rock outcrop	10	Not rated		Not rated	
LuC:					
Lithic Udorthents, leveled land	85	Not rated		Not rated	
LxG:					
Lithic Udorthents, cut land	50	Not rated		Not rated	
Rock outcrop	40	Not rated		Not rated	
NaB:					
Nallen	80	Not limited		Not limited	
NaC:					
Nallen	75	Not limited		Not limited	
NaD:					
Nallen	75	Somewhat limited		Not limited	
		Slope	0.50		
PsA:					
Pope, rarely flooded	85	Not limited		Not limited	
PvA:					
Pope, occasionally flooded	50	Not limited		Not limited	
Craigsville, occasionally flooded	30	Not limited		Not limited	

Table 13.—Recreation, Part II (Trail Management)—Continued

Map unit symbol and soil name	Pct. of map unit	Foot traffic and equestrian trails: Rating class and limiting features	Value	Mountain bike and off-road vehicle trails: Rating class and limiting features	Value
Rw:					
Riverwash, frequently flooded-	95	Not rated		Not rated	
ThB:					
Typic Haplorthods, rarely flooded-----	80	Very limited		Very limited	
		Large stones content	1.00	Large stones content	1.00
UgC:					
Udorthents, graded--	85	Not rated		Not rated	
UgF:					
Udorthents, graded--	85	Not rated		Not rated	
Ur:					
Udorthents, railroad grade-----	93	Not rated		Not rated	
Uu:					
Udorthents, highways	70	Not rated		Not rated	
Urban land, highways	25	Not rated		Not rated	
W:					
Water---------------	100	Not rated		Not rated	
Wr:					
Water---------------	75	Not rated		Not rated	
Rubble land, frequently flooded-	25	Not rated		Not rated	

Table 14.—Dwellings and Small Commercial Buildings

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Dwellings without basements: Rating class and limiting features	Value	Dwellings with basements: Rating class and limiting features	Value	Small commercial buildings: Rating class and limiting features	Value
AgC:							
Allegheny	80	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.63	Slope	0.63	Slope	1.00
BhG:							
Berks	35	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
				Depth to hard bedrock	1.00		
Highsplint	30	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
Sharondale	20	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
BuC:							
Buchanan	80	Somewhat limited		Very limited		Very limited	
		Slope	0.63	Depth to saturated zone	1.00	Slope	1.00
		Depth to thin cemented pan	0.50	Slope	0.63	Depth to saturated zone	0.39
		Depth to saturated zone	0.39				
ClB:							
Clifftop	80	Not limited		Somewhat limited		Somewhat limited	
				Depth to soft bedrock	0.10	Slope	0.28
ClC:							
Clifftop	80	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.63	Slope	0.63	Slope	1.00
				Depth to soft bedrock	0.10		
ClD:							
Clifftop	75	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
				Depth to soft bedrock	0.10		
ClE:							
Clifftop	70	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
				Depth to soft bedrock	0.10		
CmC:							
Clifftop	75	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.04	Depth to soft bedrock	0.10	Slope	1.00
				Slope	0.04		

Table 14.—Dwellings and Small Commercial Buildings—Continued

Map unit symbol and soil name	Pct. of map unit	Dwellings without basements: Rating class and limiting features	Value	Dwellings with basements: Rating class and limiting features	Value	Small commercial buildings: Rating class and limiting features	Value
CwB:							
Cottonbend	90	Not limited		Not limited		Somewhat limited	
						Slope	0.12
CwC:							
Cottonbend	90	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.63	Slope	0.63	Slope	1.00
DkC:							
Dekalb	80	Somewhat limited		Very limited		Very limited	
		Depth to hard bedrock	0.32	Depth to hard bedrock	1.00	Slope	1.00
		Large stones	0.14	Large stones	0.14	Depth to hard bedrock	0.32
		Slope	0.04	Slope	0.04	Large stones	0.14
DrE:							
Dekalb	55	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	0.32	Depth to hard bedrock	1.00	Depth to hard bedrock	0.32
		Large stones	0.14	Large stones	0.14	Large stones	0.14
Rock outcrop	15	Not rated		Not rated		Not rated	
FeB:							
Fenwick	85	Somewhat limited		Very limited		Somewhat limited	
		Depth to saturated zone	0.95	Depth to saturated zone	1.00	Depth to saturated zone	0.95
				Depth to hard bedrock	1.00	Slope	0.50
FeC:							
Fenwick	85	Somewhat limited		Very limited		Very limited	
		Depth to saturated zone	0.95	Depth to saturated zone	1.00	Slope	1.00
		Slope	0.63	Depth to hard bedrock	1.00	Depth to saturated zone	0.95
				Slope	0.63		
HgE:							
Highsplint	70	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
LaC:							
Laidig	70	Somewhat limited		Very limited		Very limited	
		Depth to thin cemented pan	0.50	Depth to saturated zone	1.00	Slope	1.00
		Slope	0.04	Slope	0.04		
LbC:							
Laidig	75	Somewhat limited		Very limited		Very limited	
		Slope	0.63	Depth to saturated zone	1.00	Slope	1.00
		Depth to thin cemented pan	0.50	Slope	0.63		
LcE:							
Laidig	45	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to thin cemented pan	0.50	Depth to saturated zone	1.00		

Table 14.—Dwellings and Small Commercial Buildings—Continued

Map unit symbol and soil name	Pct. of map unit	Dwellings without basements: Rating class and limiting features	Value	Dwellings with basements: Rating class and limiting features	Value	Small commercial buildings: Rating class and limiting features	Value
LcE:							
Clifftop	25	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
				Depth to soft bedrock	0.10		
LdF:							
Layland	60	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
Clifftop	20	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
				Depth to soft bedrock	0.10		
LhE:							
Layland	60	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
Laidig	25	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to thin cemented pan	0.50	Depth to saturated zone	1.00		
LkE:							
Layland	55	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
Laidig	30	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to thin cemented pan	0.50	Depth to saturated zone	1.00		
LmF:							
Layland	60	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
Rock outcrop	10	Not rated		Not rated		Not rated	
LuC:							
Lithic Udorthents, leveled land	85	Not rated		Not rated		Not rated	
LxG:							
Lithic Udorthents, cut land	50	Not rated		Not rated		Not rated	
Rock outcrop	40	Not rated		Not rated		Not rated	
NaB:							
Nallen	80	Somewhat limited		Very limited		Somewhat limited	
		Depth to hard bedrock	0.15	Depth to hard bedrock	1.00	Slope	0.50
						Depth to hard bedrock	0.15
NaC:							
Nallen	75	Somewhat limited		Very limited		Very limited	
		Slope	0.63	Depth to hard bedrock	1.00	Slope	1.00
		Depth to hard bedrock	0.15	Slope	0.63	Depth to hard bedrock	0.15

Table 14.—Dwellings and Small Commercial Buildings—Continued

Map unit symbol and soil name	Pct. of map unit	Dwellings without basements: Rating class and limiting features	Value	Dwellings with basements: Rating class and limiting features	Value	Small commercial buildings: Rating class and limiting features	Value
NaD:							
Nallen	75	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Slope	1.00
		Depth to hard bedrock	0.15	Depth to hard bedrock	1.00	Depth to hard bedrock	0.15
PsA:							
Pope, rarely flooded	85	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
PvA:							
Pope, occasionally flooded	50	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
Craigsville, occasionally flooded	30	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
				Depth to saturated zone	0.35		
Rw:							
Riverwash, frequently flooded	95	Not rated		Not rated		Not rated	
ThB:							
Typic Haplorthods, rarely flooded	80	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Large stones	0.73	Large stones	0.73	Large stones	0.73
UgC:							
Udorthents, graded	85	Not rated		Not rated		Not rated	
UgF:							
Udorthents, graded	85	Not rated		Not rated		Not rated	
Ur:							
Udorthents, railroad grade	93	Not rated		Not rated		Not rated	
Uu:							
Udorthents, highways	70	Not rated		Not rated		Not rated	
Urban land, highways	25	Not rated		Not rated		Not rated	
W:							
Water	100	Not rated		Not rated		Not rated	
Wr:							
Water	75	Not rated		Not rated		Not rated	
Rubble land, frequently flooded	25	Not rated		Not rated		Not rated	

Table 15.—Roads and Streets, Shallow Excavations, and Landscaping

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Local roads and streets: Rating class and limiting features	Value	Shallow excavations: Rating class and limiting features	Value	Landscaping: Rating class and limiting features	Value
AgC:							
Allegheny	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Slope	0.63	Slope	0.63	Slope	0.63
		Frost action	0.50	Unstable excavation walls	0.10		
BhG:							
Berks	35	Very limited		Very limited		Very limited	
		Too steep	1.00	Depth to hard bedrock	1.00	Too steep	1.00
		Frost action	0.50	Too steep	1.00	Droughty	0.51
				Unstable excavation walls	0.10	Large stones	0.20
Highsplint	30	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Unstable excavation walls	0.10	Large stones	0.20
Sharondale	20	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Unstable excavation walls	0.10	Large stones	0.20
BuC:							
Buchanan	80	Somewhat limited		Very limited		Somewhat limited	
		Slope	0.63	Depth to saturated zone	1.00	Slope	0.63
		Frost action	0.50	Slope	0.63	Depth to saturated zone	0.19
		Depth to saturated zone	0.19	Unstable excavation walls	0.10		
ClB:							
Clifftop	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Frost action	0.50	Depth to soft bedrock	0.10	Depth to bedrock	0.10
				Unstable excavation walls	0.10		
ClC:							
Clifftop	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Slope	0.63	Slope	0.63	Slope	0.63
		Frost action	0.50	Depth to soft bedrock	0.10	Depth to bedrock	0.10
				Unstable excavation walls	0.10		
ClD:							
Clifftop	75	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Depth to soft bedrock	0.10	Depth to bedrock	0.10
				Unstable excavation walls	0.10		

Table 15.—Roads and Streets, Shallow Excavations, and Landscaping—Continued

Map unit symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
ClE:							
Clifftop	70	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Depth to soft bedrock	0.10	Depth to bedrock	0.10
				Unstable excavation walls	0.10		
CmC:							
Clifftop	75	Somewhat limited		Somewhat limited		Somewhat limited	
		Frost action	0.50	Depth to soft bedrock	0.10	Large stones	0.20
		Slope	0.04	Unstable excavation walls	0.10	Depth to bedrock	0.10
				Slope	0.04	Slope	0.04
CwB:							
Cottonbend	90	Somewhat limited		Somewhat limited		Not limited	
		Low strength	0.78	Unstable excavation walls	0.10		
		Frost action	0.50				
CwC:							
Cottonbend	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Low strength	0.78	Slope	0.63	Slope	0.63
		Slope	0.63	Unstable excavation walls	0.10		
		Frost action	0.50				
DkC:							
Dekalb	80	Somewhat limited		Very limited		Very limited	
		Frost action	0.50	Depth to hard bedrock	1.00	Large stones	1.00
		Depth to hard bedrock	0.32	Large stones	0.14	Droughty	0.32
		Large stones	0.14	Unstable excavation walls	0.10	Depth to bedrock	0.32
		Slope	0.04	Slope	0.04	Slope	0.04
DrE:							
Dekalb	55	Very limited		Very limited		Very limited	
		Too steep	1.00	Depth to hard bedrock	1.00	Too steep	1.00
		Frost action	0.50	Too steep	1.00	Large stones	1.00
		Depth to hard bedrock	0.32	Large stones	0.14	Depth to bedrock	0.32
		Large stones	0.14	Unstable excavation walls	0.10	Droughty	0.32
Rock outcrop	15	Not rated		Not rated		Not rated	
FeB:							
Fenwick	85	Somewhat limited		Very limited		Somewhat limited	
		Low strength	0.78	Depth to hard bedrock	1.00	Depth to saturated zone	0.68
		Depth to saturated zone	0.68	Depth to saturated zone	1.00		
		Frost action	0.50	Unstable excavation walls	0.10		

Table 15.—Roads and Streets, Shallow Excavations, and Landscaping—Continued

Map unit symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
FeC:							
Fenwick	85	Somewhat limited		Very limited		Somewhat limited	
		Low strength	0.78	Depth to hard bedrock	1.00	Depth to saturated zone	0.68
		Depth to saturated zone	0.68	Depth to saturated zone	1.00	Slope	0.63
		Slope	0.63	Slope	0.63		
		Frost action	0.50	Unstable excavation walls	0.10		
HgE:							
Highsplint	70	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Unstable excavation walls	0.10	Large stones	0.20
LaC:							
Laidig	70	Somewhat limited		Very limited		Very limited	
		Frost action	0.50	Depth to saturated zone	1.00	Large stones	1.00
		Slope	0.04	Unstable excavation walls	1.00	Slope	0.04
				Slope	0.04		
LbC:							
Laidig	75	Somewhat limited		Very limited		Very limited	
		Slope	0.63	Depth to saturated zone	1.00	Large stones	1.00
		Frost action	0.50	Unstable excavation walls	1.00	Slope	0.63
				Slope	0.63		
LcE:							
Laidig	45	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Depth to saturated zone	1.00	Large stones	0.20
				Unstable excavation walls	1.00		
Clifftop	25	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Depth to soft bedrock	0.10	Large stones	0.20
				Unstable excavation walls	0.10	Depth to bedrock	0.10
LdF:							
Layland	60	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Unstable excavation walls	1.00	Large stones	0.20
Clifftop	20	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Depth to soft bedrock	0.10	Large stones	0.20
				Unstable excavation walls	0.10	Depth to bedrock	0.10

Table 15.—Roads and Streets, Shallow Excavations, and Landscaping—Continued

Map unit symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
LhE:							
Layland	60	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Unstable excavation walls	1.00	Large stones	1.00
Laidig	25	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Depth to saturated zone	1.00	Large stones	1.00
				Unstable excavation walls	1.00		
LkE:							
Layland	55	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Unstable excavation walls	1.00	Large stones	1.00
Laidig	30	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Depth to saturated zone	1.00	Large stones	1.00
				Unstable excavation walls	1.00		
LmF:							
Layland	60	Very limited		Very limited		Very limited	
		Too steep	1.00	Too steep	1.00	Too steep	1.00
		Frost action	0.50	Unstable excavation walls	1.00	Large stones	1.00
Rock outcrop	10	Not rated		Not rated		Not rated	
LuC:							
Lithic Udorthents, leveled land	85	Not rated		Not rated		Not rated	
LxG:							
Lithic Udorthents, cut land	50	Not rated		Not rated		Not rated	
Rock outcrop	40	Not rated		Not rated		Not rated	
NaB:							
Nallen	80	Somewhat limited		Very limited		Somewhat limited	
		Frost action	0.50	Depth to hard bedrock	1.00	Depth to bedrock	0.16
		Depth to hard bedrock	0.15	Unstable excavation walls	0.10		
NaC:							
Nallen	75	Somewhat limited		Very limited		Somewhat limited	
		Slope	0.63	Depth to hard bedrock	1.00	Slope	0.63
		Frost action	0.50	Slope	0.63	Depth to bedrock	0.16
		Depth to hard bedrock	0.15	Unstable excavation walls	0.10		

Table 15.—Roads and Streets, Shallow Excavations, and Landscaping—Continued

Map unit symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
NaD:							
Nallen	75	Very limited		Very limited		Very limited	
		Too steep	1.00	Depth to hard bedrock	1.00	Too steep	1.00
		Frost action	0.50	Too steep	1.00	Depth to bedrock	0.16
		Depth to hard bedrock	0.15	Unstable excavation walls	0.10		
PsA:							
Pope, rarely flooded	85	Somewhat limited		Very limited		Not limited	
		Frost action	0.50	Unstable excavation walls	1.00		
		Flooding	0.40				
PvA:							
Pope, occasionally flooded	50	Very limited		Very limited		Somewhat limited	
		Flooding	1.00	Unstable excavation walls	1.00	Flooding	0.60
		Frost action	0.50	Flooding	0.60		
Craigsville, occasionally flooded	30	Very limited		Very limited		Somewhat limited	
		Flooding	1.00	Unstable excavation walls	1.00	Flooding	0.60
		Frost action	0.50	Flooding	0.60	Droughty	0.28
				Depth to saturated zone	0.35		
Rw:							
Riverwash, frequently flooded	95	Not rated		Not rated		Not rated	
ThB:							
Typic Haplorthods, rarely flooded	80	Somewhat limited		Very limited		Very limited	
		Large stones	0.73	Unstable excavation walls	1.00	Large stones	1.00
		Flooding	0.40	Large stones	0.73	Droughty	0.45
UgC:							
Udorthents, graded	85	Not rated		Not rated		Not rated	
UgF:							
Udorthents, graded	85	Not rated		Not rated		Not rated	
Ur:							
Udorthents, railroad grade	93	Not rated		Not rated		Not rated	
Uu:							
Udorthents, highways	70	Not rated		Not rated		Not rated	
Urban land, highways	25	Not rated		Not rated		Not rated	
W:							
Water	100	Not rated		Not rated		Not rated	
Wr:							
Water	75	Not rated		Not rated		Not rated	
Rubble land, frequently flooded	25	Not rated		Not rated		Not rated	

Table 16.—Sewage Disposal

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
AgC:					
Allegheny	80	Very limited		Very limited	
		Slow water movement	1.00	Slope	1.00
		Slope	0.63	Seepage	0.52
BhG:					
Berks	35	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
Highsplint	30	Very limited		Very limited	
		Too steep	1.00	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Sharondale	20	Very limited		Very limited	
		Too steep	1.00	Slope	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
		Slow water movement	1.00		
BuC:					
Buchanan	80	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Depth to saturated zone	0.75
		Slope	0.63	Seepage	0.50
ClB:					
Clifftop	80	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	0.50	Slope	0.82
				Seepage	0.50
ClC:					
Clifftop	80	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	0.63	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
ClD:					
Clifftop	75	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to soft bedrock	1.00
		Too steep	1.00	Slope	1.00
		Slow water movement	0.50	Seepage	0.50

Table 16.—Sewage Disposal—Continued

Map unit symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
ClE:					
Clifftop	70	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to soft bedrock	1.00
		Too steep	1.00	Slope	1.00
		Slow water movement	0.61	Seepage	0.50
CmC:					
Clifftop	75	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slow water movement	0.50	Slope	1.00
		Slope	0.04	Seepage	0.50
CwB:					
Cottonbend	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.68
				Seepage	0.50
CwC:					
Cottonbend	90	Somewhat limited		Very limited	
		Slope	0.63	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
DkC:					
Dekalb	80	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
				Slope	1.00
		Filtering capacity	1.00	Large stones	0.18
		Large stones	0.14		
		Slope	0.04		
DrE:					
Dekalb	55	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
				Large stones	0.18
		Filtering capacity	1.00		
		Large stones	0.14		
Rock outcrop	15	Not rated		Not rated	
FeB:					
Fenwick	85	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to hard bedrock	1.00
		Slow water movement	1.00	Depth to saturated zone	1.00
		Shallow depth to bedrock	1.00	Slope	0.92
				Seepage	0.50

Table 16.—Sewage Disposal—Continued

Map unit symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
FeC:					
Fenwick	85	Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to hard bedrock	1.00
		Slow water movement	1.00	Slope	1.00
		Shallow depth to bedrock	1.00	Depth to saturated zone	1.00
		Slope	0.63	Seepage	0.50
HgE:					
Highsplint	70	Very limited		Very limited	
		Too steep	1.00	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
LaC:					
Laidig	70	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Organic matter content	1.00
		Slope	0.04	Seepage	0.52
				Depth to saturated zone	0.10
LbC:					
Laidig	75	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Seepage	0.42
		Slope	0.63	Depth to saturated zone	0.10
LcE:					
Laidig	45	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Seepage	0.52
		Too steep	1.00	Depth to saturated zone	0.10
Clifftop	25	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to soft bedrock	1.00
		Too steep	1.00	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
LdF:					
Layland	60	Very limited		Very limited	
		Too steep	1.00	Slope	1.00
		Slow water movement	0.98	Seepage	0.54
Clifftop	20	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to soft bedrock	1.00
		Too steep	1.00	Slope	1.00
		Slow water movement	0.50	Seepage	0.50

Table 16.—Sewage Disposal—Continued

Map unit symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
LhE:					
Layland	60	Very limited		Very limited	
		Too steep	1.00	Slope	1.00
		Slow water movement	0.98	Organic matter content	1.00
				Seepage	0.54
Laidig	25	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Seepage	0.52
		Too steep	1.00	Depth to saturated zone	0.10
LkE:					
Layland	55	Very limited		Very limited	
		Too steep	1.00	Slope	1.00
		Slow water movement	0.98	Organic matter content	1.00
				Seepage	0.54
Laidig	30	Very limited		Very limited	
		Depth to saturated zone	1.00	Slope	1.00
		Slow water movement	1.00	Organic matter content	1.00
		Too steep	1.00	Seepage	0.52
				Depth to saturated zone	0.10
LmF:					
Layland	60	Very limited		Very limited	
		Too steep	1.00	Slope	1.00
		Slow water movement	0.98	Organic matter content	1.00
				Seepage	0.54
Rock outcrop	10	Not rated		Not rated	
LuC:					
Lithic Udorthents, leveled land	85	Not rated		Not rated	
LxG:					
Lithic Udorthents, cut land	50	Not rated		Not rated	
Rock outcrop	40	Not rated		Not rated	
NaB:					
Nallen	80	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
				Slope	0.92
NaC:					
Nallen	75	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Seepage, bottom layer	1.00	Slope	1.00
		Slope	0.63	Seepage	1.00

Table 16.—Sewage Disposal—Continued

Map unit symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
NaD:					
Nallen	75	Very limited		Very limited	
		Shallow depth to bedrock	1.00	Depth to hard bedrock	1.00
		Too steep	1.00	Slope	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
PsA:					
Pope, rarely flooded	85	Very limited		Very limited	
		Seepage, bottom layer	1.00	Seepage	1.00
		Flooding	0.40	Flooding	0.40
PvA:					
Pope, occasionally flooded	50	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
Craigsville, occasionally flooded	30	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Filtering capacity	1.00	Seepage	1.00
		Seepage, bottom layer	1.00	Depth to saturated zone	0.17
		Depth to saturated zone	0.84		
Rw:					
Riverwash, frequently flooded	95	Not rated		Not rated	
ThB:					
Typic Haplorthods, rarely flooded	80	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
		Seepage, bottom layer	1.00	Flooding	0.40
		Large stones	0.73	Slope	0.32
		Flooding	0.40	Large stones	0.05
UgC:					
Udorthents, graded	85	Not rated		Not rated	
UgF:					
Udorthents, graded	85	Not rated		Not rated	
Ur:					
Udorthents, railroad grade	93	Not rated		Not rated	
Uu:					
Udorthents, highways	70	Not rated		Not rated	
Urban land, highways	25	Not rated		Not rated	

Table 16.—Sewage Disposal—Continued

Map unit symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
W:					
Water	100	Not rated		Not rated	
Wr:					
Water	75	Not rated		Not rated	
Rubble land, frequently flooded	25	Not rated		Not rated	

Table 17.—Source of Gravel and Sand

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The ratings given for the thickest layer are for the thickest layer above and excluding the bottom layer. The numbers in the value columns range from 0.00 to 0.99. The greater the value, the greater the likelihood that the bottom layer or thickest layer of the soil is a source of sand or gravel. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Gravel source: Rating class and limiting features	Gravel source: Value	Sand source: Rating class and limiting features	Sand source: Value
AgC:					
Allegheny	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
BhG:					
Berks	35	Fair		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.08	Thickest layer	0.00
Highsplint	30	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Sharondale	20	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
BuC:					
Buchanan	80	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.02
ClB:					
Clifftop	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
ClC:					
Clifftop	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
ClD:					
Clifftop	75	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
ClE:					
Clifftop	70	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
CmC:					
Clifftop	75	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
CwB:					
Cottonbend	90	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00

Table 17.—Source of Gravel and Sand—Continued

Map unit symbol and soil name	Pct. of map unit	Gravel source: Rating class and limiting features	Gravel source: Value	Sand source: Rating class and limiting features	Sand source: Value
CwC:					
Cottonbend	90	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
DkC:					
Dekalb	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
DrE:					
Dekalb	55	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Rock outcrop	15	Not rated		Not rated	
FeB:					
Fenwick	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
FeC:					
Fenwick	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
HgE:					
Highsplint	70	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
LaC:					
Laidig	70	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
LbC:					
Laidig	75	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
LcE:					
Laidig	45	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
Clifftop	25	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
LdF:					
Layland	60	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Clifftop	20	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00

Table 17.—Source of Gravel and Sand—Continued

Map unit symbol and soil name	Pct. of map unit	Gravel source: Rating class and limiting features	Gravel source: Value	Sand source: Rating class and limiting features	Sand source: Value
LhE:					
Layland	60	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Laidig	25	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
LkE:					
Layland	55	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Laidig	30	Poor		Poor	
		Thickest layer	0.00	Bottom layer	0.00
		Bottom layer	0.00	Thickest layer	0.00
LmF:					
Layland	60	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Rock outcrop	10	Not rated		Not rated	
LuC:					
Lithic Udorthents, leveled land	85	Not rated		Not rated	
LxG:					
Lithic Udorthents, cut land	50	Not rated		Not rated	
Rock outcrop	40	Not rated		Not rated	
NaB:					
Nallen	80	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.01
		Thickest layer	0.00	Thickest layer	0.03
NaC:					
Nallen	75	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.01
		Thickest layer	0.00	Thickest layer	0.03
NaD:					
Nallen	75	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.01
		Thickest layer	0.00	Thickest layer	0.03
PsA:					
Pope, rarely flooded	85	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.03
		Thickest layer	0.00	Thickest layer	0.09
PvA:					
Pope, occasionally flooded	50	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.03
		Thickest layer	0.00	Thickest layer	0.09

Table 17.—Source of Gravel and Sand—Continued

Map unit symbol and soil name	Pct. of map unit	Gravel source: Rating class and limiting features	Gravel source: Value	Sand source: Rating class and limiting features	Sand source: Value
PvA:					
Craigsville, occasionally flooded	30	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.12
		Thickest layer	0.00	Thickest layer	0.16
Rw:					
Riverwash, frequently flooded	95	Not rated		Not rated	
ThB:					
Typic Haplorthods, rarely flooded	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
UgC:					
Udorthents, graded	85	Not rated		Not rated	
UgF:					
Udorthents, graded	85	Not rated		Not rated	
Ur:					
Udorthents, railroad grade	93	Not rated		Not rated	
Uu:					
Udorthents, highways	70	Not rated		Not rated	
Urban land, highways	25	Not rated		Not rated	
W:					
Water	90	Not rated		Not rated	
Wr:					
Water	75	Not rated		Not rated	
Rubble land, frequently flooded	25	Not rated		Not rated	

Table 18.—Source of Reclamation Material, Roadfill, and Topsoil

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.00 to 0.99. The smaller the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Source of reclamation material: Rating class and limiting features	Value	Roadfill source: Rating class and limiting features	Value	Topsoil source: Rating class and limiting features	Value
AgC:							
Allegheny-----------	80	Fair		Good		Fair	
		Organic matter content low	0.12			Slope	0.37
		Too acid	0.50			Too clayey	0.48
		Water erosion	0.99			Too acid	0.59
BhG:							
Berks---------------	35	Poor		Poor		Poor	
		Droughty	0.00	Depth to bedrock	0.00	Slope	0.00
		Too acid	0.50	Slope	0.00	Rock fragments	0.00
				Cobble content	0.99	Too acid	0.76
Highsplint----------	30	Fair		Poor		Poor	
		Too acid	0.26	Slope	0.00	Slope	0.00
		Organic matter content low	0.82			Rock fragments	0.00
						Hard to reclaim (rock fragments)	0.00
Sharondale----------	20	Fair		Poor		Poor	
		Too acid	0.84	Slope	0.00	Slope	0.00
						Rock fragments	0.00
						Hard to reclaim (rock fragments)	0.00
BuC:							
Buchanan------------	80	Fair		Fair		Poor	
		Too acid	0.03	Wetness depth	0.53	Rock fragments	0.00
		Organic matter content low	0.12			Slope	0.37
						Wetness depth	0.53
ClB:							
Clifftop------------	80	Fair		Poor		Poor	
		Too acid	0.50	Depth to bedrock	0.00	Rock fragments	0.00
		Organic matter content low	0.82			Too acid	0.68
		Water erosion	0.99			Too clayey	0.69
ClC:							
Clifftop------------	80	Fair		Poor		Poor	
		Too acid	0.50	Depth to bedrock	0.00	Rock fragments	0.00
		Organic matter content low	0.82			Slope	0.37
		Water erosion	0.99			Too acid	0.68
ClD:							
Clifftop------------	75	Fair		Poor		Poor	
		Too acid	0.50	Depth to bedrock	0.00	Slope	0.00
		Organic matter content low	0.82	Slope	0.50	Rock fragments	0.00
		Water erosion	0.99			Too acid	0.68

Table 18.—Source of Reclamation Material, Roadfill, and Topsoil—Continued

Map unit symbol and soil name	Pct. of map unit	Source of reclamation material: Rating class and limiting features	Value	Roadfill source: Rating class and limiting features	Value	Topsoil source: Rating class and limiting features	Value
ClE:							
Clifftop	70	Fair		Poor		Poor	
		Too acid	0.50	Depth to bedrock	0.00	Slope	0.00
		Organic matter content low	0.82	Slope	0.00	Rock fragments	0.32
						Too acid	0.68
		Water erosion	0.99				
CmC:							
Clifftop	75	Fair		Poor		Poor	
		Too acid	0.50	Depth to bedrock	0.00	Rock fragments	0.00
		Organic matter content low	0.82			Too acid	0.68
						Too clayey	0.69
		Droughty	0.86				
CwB:							
Cottonbend	90	Fair		Good		Fair	
		Organic matter content low	0.12			Too acid	0.50
		Too acid	0.50				
		Water erosion	0.90				
CwC:							
Cottonbend	90	Fair		Good		Fair	
		Too acid	0.08			Slope	0.37
		Organic matter content low	0.12			Too acid	0.50
		Water erosion	0.99				
DkC:							
Dekalb	80	Fair		Poor		Poor	
		Droughty	0.01	Depth to bedrock	0.00	Rock fragments	0.00
		Too acid	0.50	Cobble content	0.29	Too acid	0.24
		Depth to bedrock	0.68			Depth to bedrock	0.68
DrE:							
Dekalb	55	Fair		Poor		Poor	
		Droughty	0.01	Depth to bedrock	0.00	Slope	0.00
		Too acid	0.50	Slope	0.00	Rock fragments	0.00
		Depth to bedrock	0.68	Cobble content	0.29	Too acid	0.24
Rock outcrop	15	Not rated		Not rated		Not rated	
FeB:							
Fenwick	85	Fair		Poor		Fair	
		Too acid	0.50	Depth to bedrock	0.00	Wetness depth	0.18
		Droughty	0.81	Wetness depth	0.18	Too acid	0.59
		Water erosion	0.90	Low strength	0.22	Rock fragments	0.92
FeC:							
Fenwick	85	Fair		Poor		Fair	
		Too acid	0.50	Depth to bedrock	0.00	Wetness depth	0.18
		Droughty	0.81	Wetness depth	0.18	Slope	0.37
		Water erosion	0.90	Low strength	0.22	Too acid	0.59
HgE:							
Highsplint	70	Fair		Poor		Poor	
		Too acid	0.26	Slope	0.00	Slope	0.00
		Organic matter content low	0.82			Rock fragments	0.00
						Hard to reclaim (rock fragments)	0.00

Table 18.—Source of Reclamation Material, Roadfill, and Topsoil—Continued

Map unit symbol and soil name	Pct. of map unit	Source of reclamation material: Rating class and limiting features	Value	Roadfill source: Rating class and limiting features	Value	Topsoil source: Rating class and limiting features	Value
LaC:							
Laidig	70	Poor		Fair		Fair	
		Too acid	0.00	Wetness depth	0.94	Rock fragments	0.18
		Organic matter content low	0.56			Too acid	0.59
						Wetness depth	0.94
LbC:							
Laidig	75	Poor		Fair		Fair	
		Too acid	0.00	Wetness depth	0.94	Rock fragments	0.18
		Organic matter content low	0.56			Too acid	0.59
						Wetness depth	0.94
LcE:							
Laidig	45	Poor		Poor		Poor	
		Too acid	0.00	Slope	0.00	Slope	0.00
		Organic matter content low	0.56	Wetness depth	0.94	Too acid	0.59
						Wetness depth	0.94
Clifftop	25	Fair		Poor		Poor	
		Too acid	0.50	Depth to bedrock	0.00	Slope	0.00
		Organic matter content low	0.82	Slope	0.00	Rock fragments	0.32
						Too acid	0.68
		Water erosion	0.99				
LdF:							
Layland	60	Fair		Poor		Poor	
		Too acid	0.03	Slope	0.00	Slope	0.00
		Organic matter content low	0.82			Hard to reclaim (rock fragments)	0.00
		Stone content	0.98			Too acid	0.59
Clifftop	20	Fair		Poor		Poor	
		Too acid	0.50	Depth to bedrock	0.00	Slope	0.00
		Organic matter content low	0.82	Slope	0.00	Rock fragments	0.32
						Too acid	0.68
		Water erosion	0.99				
LhE:							
Layland	60	Fair		Poor		Poor	
		Too acid	0.03	Slope	0.00	Slope	0.00
		Organic matter content low	0.82			Hard to reclaim (rock fragments)	0.00
		Stone content	0.88			Too acid	0.59
Laidig	25	Poor		Poor		Poor	
		Too acid	0.00	Slope	0.00	Slope	0.00
		Organic matter content low	0.56	Wetness depth	0.94	Too acid	0.59
						Wetness depth	0.94
LkE:							
Layland	55	Fair		Poor		Poor	
		Too acid	0.03	Slope	0.00	Slope	0.00
		Stone content	0.79			Hard to reclaim (rock fragments)	0.00
		Organic matter content low	0.82			Too acid	0.59
Laidig	30	Poor		Poor		Poor	
		Too acid	0.00	Slope	0.00	Slope	0.00
		Organic matter content low	0.56	Wetness depth	0.94	Too acid	0.59
						Wetness depth	0.94

Table 18.—Source of Reclamation Material, Roadfill, and Topsoil—Continued

Map unit symbol and soil name	Pct. of map unit	Source of reclamation material: Rating class and limiting features	Value	Roadfill source: Rating class and limiting features	Value	Topsoil source: Rating class and limiting features	Value
LmF:							
Layland	60	Fair		Poor		Poor	
		Too acid	0.03	Slope	0.00	Slope	0.00
		Stone content	0.79			Hard to reclaim (rock fragments)	0.00
		Organic matter content low	0.82			Too acid	0.59
Rock outcrop	10	Not rated		Not rated		Not rated	
LuC:							
Lithic Udorthents, leveled land	85	Not rated		Not rated		Not rated	
LxG:							
Lithic Udorthents, cut land	50	Not rated		Not rated		Not rated	
Rock outcrop	40	Not rated		Not rated		Not rated	
NaB:							
Nallen	80	Fair		Poor		Fair	
		Organic matter content low	0.10	Depth to bedrock	0.00	Too acid	0.50
		Droughty	0.26			Depth to bedrock	0.84
		Too acid	0.50			Rock fragments	0.96
NaC:							
Nallen	75	Fair		Poor		Fair	
		Organic matter content low	0.10	Depth to bedrock	0.00	Slope	0.37
		Droughty	0.26			Too acid	0.50
		Too acid	0.50			Depth to bedrock	0.84
NaD:							
Nallen	75	Fair		Poor		Poor	
		Organic matter content low	0.10	Depth to bedrock	0.00	Slope	0.00
				Slope	0.50	Too acid	0.50
		Droughty	0.26			Depth to bedrock	0.84
		Too acid	0.50				
PsA:							
Pope, rarely flooded	85	Fair		Good		Poor	
		Too acid	0.50			Hard to reclaim (rock fragments)	0.00
						Too acid	0.59
						Rock fragments	0.92
PvA:							
Pope, occasionally flooded	50	Fair		Good		Poor	
		Too acid	0.50			Hard to reclaim (rock fragments)	0.00
						Too acid	0.59
						Rock fragments	0.92
Craigsville, occasionally flooded	30	Fair		Good		Poor	
		Too sandy	0.09			Rock fragments	0.00
		Too acid	0.50			Hard to reclaim (rock fragments)	0.00
						Too sandy	0.09

Table 18.—Source of Reclamation Material, Roadfill, and Topsoil—Continued

Map unit symbol and soil name	Pct. of map unit	Source of reclamation material: Rating class and limiting features	Value	Roadfill source: Rating class and limiting features	Value	Topsoil source: Rating class and limiting features	Value
Rw:							
Riverwash, frequently flooded	95	Not rated		Not rated		Not rated	
ThB:							
Typic Haplorthods, rarely flooded	80	Poor		Poor		Poor	
		Stone content	0.00	Stones	0.00	Hard to reclaim (rock fragments)	0.00
		Organic matter content low	0.12			Rock fragments	0.00
		Too acid	0.50			Too acid	0.32
UgC:							
Udorthents, graded	85	Not rated		Not rated		Not rated	
UgF:							
Udorthents, graded	85	Not rated		Not rated		Not rated	
Ur:							
Udorthents, railroad grade	93	Not rated		Not rated		Not rated	
Uu:							
Udorthents, highways	70	Not rated		Not rated		Not rated	
Urban land, highways	25	Not rated		Not rated		Not rated	
W:							
Water	100	Not rated		Not rated		Not rated	
Wr:							
Water	75	Not rated		Not rated		Not rated	
Rubble land, frequently flooded	25	Not rated		Not rated		Not rated	

Table 19.—Ponds and Embankments

(Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map unit symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
AgC:							
Allegheny	80	Very limited		Very limited		Very limited	
		Slope	1.00	Piping	1.00	Depth to water	1.00
		Seepage	0.12				
BhG:							
Berks	35	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Thin layer	0.54	Depth to water	1.00
		Slope	1.00				
		Depth to bedrock	0.54				
Highsplint	30	Very limited		Not limited		Very limited	
		Slope	1.00			Depth to water	1.00
		Seepage	0.70				
Sharondale	20	Very limited		Not limited		Very limited	
		Seepage	1.00			Depth to water	1.00
		Slope	1.00				
BuC:							
Buchanan	80	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to saturated zone	1.00	Depth to water	1.00
		Seepage	0.70	Piping	1.00		
ClB:							
Clifftop	80	Somewhat limited		Very limited		Very limited	
		Seepage	0.70	Piping	1.00	Depth to water	1.00
		Slope	0.50	Thin layer	0.70		
		Depth to bedrock	0.04				
ClC:							
Clifftop	80	Very limited		Very limited		Very limited	
		Slope	1.00	Piping	1.00	Depth to water	1.00
		Seepage	0.70	Thin layer	0.70		
		Depth to bedrock	0.04				
ClD:							
Clifftop	75	Very limited		Very limited		Very limited	
		Slope	1.00	Piping	1.00	Depth to water	1.00
		Seepage	0.70	Thin layer	0.70		
		Depth to bedrock	0.04				
ClE:							
Clifftop	70	Very limited		Very limited		Very limited	
		Slope	1.00	Piping	1.00	Depth to water	1.00
		Seepage	0.70	Thin layer	0.70		
		Depth to bedrock	0.04				
CmC:							
Clifftop	75	Very limited		Very limited		Very limited	
		Slope	1.00	Piping	1.00	Depth to water	1.00
		Seepage	0.70	Thin layer	0.70		
		Depth to bedrock	0.04				

Table 19.—Ponds and Embankments—Continued

Map unit symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
CwB:							
Cottonbend	90	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.88	Depth to water	1.00
		Slope	0.32				
CwC:							
Cottonbend	90	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Piping	0.88	Depth to water	1.00
		Seepage	0.70				
DkC:							
Dekalb	80	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Thin layer	0.82	Depth to water	1.00
		Slope	1.00	Large stones	0.14		
		Depth to bedrock	0.82				
DrE:							
Dekalb	55	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Thin layer	0.82	Depth to water	1.00
		Slope	1.00	Large stones	0.14		
		Depth to bedrock	0.82				
Rock outcrop	15	Not rated		Not rated		Not rated	
FeB:							
Fenwick	85	Somewhat limited		Very limited		Very limited	
		Seepage	0.70	Depth to saturated zone	1.00	Depth to hard bedrock	1.00
		Slope	0.68	Piping	0.77	Unstable excavation walls	0.50
		Depth to bedrock	0.52	Thin layer	0.52	Slow refill	0.30
FeC:							
Fenwick	85	Very limited		Very limited		Very limited	
		Slope	1.00	Depth to saturated zone	1.00	Depth to hard bedrock	1.00
		Seepage	0.70	Piping	0.77	Unstable excavation walls	0.50
		Depth to bedrock	0.52	Thin layer	0.52	Slow refill	0.30
HgE:							
Highsplint	70	Very limited		Not limited		Very limited	
		Slope	1.00			Depth to water	1.00
		Seepage	0.70				
LaC:							
Laidig	70	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Depth to saturated zone	0.78	Depth to water	1.00
		Seepage	0.72				
LbC:							
Laidig	75	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Depth to saturated zone	0.78	Depth to water	1.00
		Seepage	0.72				
LcE:							
Laidig	45	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Depth to saturated zone	0.78	Depth to water	1.00
		Seepage	0.72				

Table 19.—Ponds and Embankments—Continued

Map unit symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
LcE:							
Clifftop	25	Very limited		Very limited		Very limited	
		Slope	1.00	Piping	1.00	Depth to water	1.00
		Seepage	0.70	Thin layer	0.70		
		Depth to bedrock	0.04				
LdF:							
Layland	60	Very limited		Not limited		Very limited	
		Slope	1.00			Depth to water	1.00
		Seepage	0.73				
Clifftop	20	Very limited		Very limited		Very limited	
		Slope	1.00	Piping	1.00	Depth to water	1.00
		Seepage	0.70	Thin layer	0.70		
		Depth to bedrock	0.04				
LhE:							
Layland	60	Very limited		Not limited		Very limited	
		Slope	1.00			Depth to water	1.00
		Seepage	0.73				
Laidig	25	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Depth to saturated zone	0.78	Depth to water	1.00
		Seepage	0.72				
LkE:							
Layland	55	Very limited		Not limited		Very limited	
		Slope	1.00			Depth to water	1.00
		Seepage	0.73				
Laidig	30	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Depth to saturated zone	0.78	Depth to water	1.00
		Seepage	0.72				
LmF:							
Layland	60	Very limited		Not limited		Very limited	
		Slope	1.00			Depth to water	1.00
		Seepage	0.73				
Rock outcrop	10	Not rated		Not rated		Not rated	
LuC:							
Lithic Udorthents, leveled land	85	Very limited		Not rated		Not rated	
		Depth to bedrock	1.00				
		Slope	0.32				
LxG:							
Lithic Udorthents, cut land	50	Very limited		Not rated		Not rated	
		Depth to bedrock	1.00				
		Slope	1.00				
Rock outcrop	40	Not rated		Not rated		Not rated	
NaB:							
Nallen	80	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Thin layer	0.74	Depth to water	1.00
		Depth to bedrock	0.74				
		Slope	0.68				

Table 19.—Ponds and Embankments—Continued

Map unit symbol and soil name	Pct. of map unit	Pond reservoir areas: Rating class and limiting features	Value	Embankments, dikes, and levees: Rating class and limiting features	Value	Aquifer-fed excavated ponds: Rating class and limiting features	Value
NaC:							
Nallen	75	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Thin layer	0.74	Depth to water	1.00
		Slope	1.00				
		Depth to bedrock	0.74				
NaD:							
Nallen	75	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Thin layer	0.74	Depth to water	1.00
		Slope	1.00				
		Depth to bedrock	0.74				
PsA:							
Pope, rarely flooded	85	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.62	Depth to water	1.00
PvA:							
Pope, occasionally flooded	50	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.62	Depth to water	1.00
Craigsville, occasionally flooded	30	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Unstable excavation walls	1.00
						Depth to saturated zone	0.96
Rw:							
Riverwash, frequently flooded	95	Not rated		Not rated		Not rated	
ThB:							
Typic Haplorthods, rarely flooded	80	Very limited		Very limited		Very limited	
		Seepage	1.00	Seepage	1.00	Depth to water	1.00
		Slope	0.08	Large stones	0.73		
UgC:							
Udorthents, graded	85	Not rated		Not rated		Not rated	
UgF:							
Udorthents, graded	85	Not rated		Not rated		Not rated	
Ur:							
Udorthents, railroad grade	93	Not rated		Not rated		Not rated	
Uu:							
Udorthents, highways	70	Not rated		Not rated		Not rated	
Urban land, highways	25	Not rated		Not rated		Not rated	
W:							
Water	100	Not rated		Not rated		Not rated	
Wr:							
Water	75	Not rated		Not rated		Not rated	
Rubble land, frequently flooded	25	Not rated		Not rated		Not rated	

Table 20.—Engineering Properties

(Absence of an entry indicates that data were not estimated)

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
AgC:												
Allegheny-------	0-1	Slightly decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	1-4	Moderately decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	4-26	Loam	CL-ML, CL, ML	A-4	0	0	90-100	80-100	65-100	45-85	0-35	NP-10
	26-42	Loam	CL-ML, CL, ML	A-4	0	0	90-100	80-100	65-100	45-85	0-35	NP-10
	42-165	Clay loam, sandy clay loam, loam	CL, SC, ML, SM	A-6, A-2-4, A-4	0	0	90-100	80-100	65-95	35-80	0-35	NP-15
BhG:												
Berks-----------	0-2	Slightly decomposed plant material	PT	A-8	1-25	0	---	---	---	---	---	---
	2-19	Channery loam, channery silt loam	SM, GM	A-4, A-2	0-6	6-36	25-93	22-93	19-93	16-85	36-55	8-15
	19-28	Channery loam, channery silt loam	SC, SM, GC, GM	A-4, A-2	0	5-44	15-94	13-93	11-93	9-82	27-43	9-15
	28-76	Very channery loam, very channery silt loam	GC-GM, SC, GC	A-4, A-2	0	8-42	19-91	16-90	14-90	12-83	26-37	9-15
	76-98	Extremely channery loam, extremely channery silt loam	GC-GM, GC	A-2	0-30	8-71	9-81	6-80	6-80	5-77	27-37	11-18
	98-108	Bedrock	---	---	---	---	---	---	---	---	---	---
Highsplint------	0-3	Slightly decomposed plant material	PT	A-8	1-25	0	---	---	---	---	---	---
	3-18	Channery loam, very channery silt loam	GM, ML	A-7-6, A-2-4, A-2-7	0-3	0-17	52-87	36-81	31-80	23-63	33-56	9-18
	18-27	Channery loam, very channery silt loam	GC, GM, ML, CL	A-6, A-2-4, A-2-6	0	7-31	61-86	43-79	36-77	28-61	27-42	9-18
	27-108	Very channery loam, very channery silt loam, very channery clay loam	GC, SC, CL	A-6, A-2-6, A-2-4, A-4	0	6-27	37-80	24-72	20-72	16-58	24-42	9-21
	108-135	Very channery loam, very channery silt loam	GC, SC	A-2-6, A-2-4, A-4	0	11-34	27-68	14-64	12-63	9-49	24-37	9-18
	135-165	Extremely channery loam, extremely channery fine sandy loam, very channery silt loam	GC, SC, CL	A-2-6, A-2-4, A-4	0-43	11-45	26-82	12-79	10-77	7-57	24-38	9-18

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
BhG:												
Sharondale------	0-5	Slightly decomposed plant material	PT	A-8	1-25	0	---	---	---	---	---	---
	5-38	Channery loam, loam, flaggy sandy loam, very channery clay loam	GC, GM, ML	A-2-6, A-2-4, A-6	0	0	39-86	22-81	18-78	13-63	32-67	9-23
	38-51	Channery loam, loam, flaggy sandy loam, very channery clay loam	GM, GC, ML	A-6, A-2-4, A-2-6	0	0	43-85	26-83	22-79	16-61	26-49	8-20
	51-160	Very channery loam, extremely flaggy silt loam, very flaggy sandy loam	GM, GC, SC	A-2-4, A-2-6	0	6-53	21-82	9-80	7-77	5-59	21-46	5-19
	160-218	Very channery loam, extremely flaggy silt loam, very flaggy sandy loam	GM, GC, SC	A-2-6, A-2-4	0	7-51	24-80	11-76	9-73	7-60	23-44	7-20
	218-228	Bedrock	---	---	---	---	---	---	---	---	---	---
BuC:												
Buchanan--------	0-3	Moderately decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	3-20	Loam, fine sandy loam	ML, CL-ML, CL	A-4	0	0-5	90-100	85-100	75-90	65-85	0-37	NP-13
	20-53	Channery loam, silt loam, gravelly sandy clay loam	GM, ML, SM, CL	A-2, A-4	0	0-20	50-100	45-90	40-90	20-80	20-35	2-15
	53-152	Channery loam, silt loam, gravelly sandy clay loam	GC, SC, CL, GM	A-4, A-2	0	0-20	50-100	45-90	40-90	20-80	20-35	2-15
	152-165	Gravelly loam, loam, channery clay loam, very channery sandy loam	GC, SC, CL, GM	A-6, A-4, A-2	0	0-20	50-100	30-80	30-75	20-60	20-35	2-15

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
ClB:												
Clifftop--------	0-3	Slightly decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	3-8	Channery silt loam	CL, GM, ML, GC	A-4, A-2	0	0-30	50-80	45-70	40-60	30-55	25-36	5-10
	8-20	Silt loam, channery silt loam, channery loam	CL, ML	A-4, A-6	0	0-5	80-95	75-90	70-85	65-80	27-43	9-12
	20-74	Channery silty clay loam, channery silt loam, channery loam, silty clay loam	SC, CL-ML, GC-GM, CL	A-4, A-7, A-5	0	0-30	50-95	45-90	35-85	30-80	20-45	4-15
	74-91	Very channery silty clay loam, very channery silt loam, channery loam, channery silty clay	GC, GC-GM	A-1, A-2, A-4, A-6	0-15	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	91-101	Bedrock	---	---	---	---	---	---	---	---	---	---
ClC:												
Clifftop--------	0-3	Slightly decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	3-8	Channery silt loam	CL, GM, ML, GC	A-4, A-2	0	0-30	50-80	45-70	40-60	30-55	25-36	5-10
	8-20	Silt loam, channery silt loam, channery loam	ML, CL	A-6, A-4	0	0-5	80-95	75-90	70-85	65-80	27-43	9-12
	20-74	Channery silty clay loam, channery silt loam, channery loam, silty clay loam	CL, SC, CL-ML, GC-GM	A-7, A-5, A-4	0	0-30	50-95	45-90	35-85	30-80	20-45	4-15
	74-91	Very channery silty clay loam, very channery silt loam, channery loam, channery silty clay	GC-GM, GC	A-1, A-6, A-2, A-4	0-15	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	91-101	Bedrock	---	---	---	---	---	---	---	---	---	---

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
ClD:												
Clifftop--------	0-3	Slightly decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	3-8	Channery silt loam	GC, GM, ML, CL	A-2, A-4	0	0-30	50-80	45-70	40-60	30-55	25-36	5-10
	8-20	Silt loam, channery silt loam, channery loam	CL, ML	A-6, A-4	0	0-5	80-95	75-90	70-85	65-80	27-43	9-12
	20-74	Channery silty clay loam, channery silt loam, channery loam, silty clay loam	CL, SC, CL-ML, GC-GM	A-5, A-4, A-7	0	0-30	50-95	45-90	35-85	30-80	20-45	4-15
	74-91	Very channery silty clay loam, very channery silt loam, channery loam, channery silty clay	GC-GM, GC	A-2, A-4, A-1, A-6	0-15	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	91-101	Bedrock	---	---	---	---	---	---	---	---	---	---
ClE:												
Clifftop--------	0-3	Slightly decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	3-8	Channery silt loam	GC, CL, GM, ML	A-2, A-4	0	0-57	64-100	27-100	21-97	17-80	25-36	5-10
	8-20	Silt loam, channery silt loam, channery loam	ML, CL	A-6, A-4	0	0-5	81-94	63-94	55-90	45-75	27-43	9-12
	20-74	Channery silty clay loam, channery silt loam, channery loam, silty clay loam	SC, CL, CL-ML, GC-GM	A-5, A-4, A-7	0	0-24	69-96	39-96	34-96	30-89	20-45	4-15
	74-91	Very channery silty clay loam, very channery silt loam, channery loam, channery silty clay	GC-GM, GC	A-1, A-2, A-4, A-6	0	0-23	48-71	24-71	20-71	18-70	20-40	4-15
	91-99	Bedrock	---	---	---	---	---	---	---	---	---	---

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
CmC:												
Clifftop	0-3	Slightly decomposed plant material	PT	A-8	1-25	0	---	---	---	---	---	---
	3-8	Channery silt loam	CL, GM, ML, GC	A-4, A-2	0	0-30	50-80	45-70	40-60	30-55	25-36	5-10
	8-20	Silt loam, channery silt loam, channery loam	CL, ML	A-4, A-6	0	0-5	80-95	75-90	70-85	65-80	27-43	9-12
	20-74	Channery silty clay loam, channery silt loam, channery loam, silty clay loam	SC, CL-ML, GC-GM, CL	A-4, A-7, A-5	0	0-30	50-95	45-90	35-85	30-80	20-45	4-15
	74-91	Very channery silty clay loam, very channery silt loam, channery loam, channery silty clay	GC, GC-GM	A-1, A-2, A-4, A-6	0-15	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	91-101	Bedrock	---	---	---	---	---	---	---	---	---	---
CwB:												
Cottonbend	0-1	Slightly decomposed plant material	---	---	0	0	---	---	---	---	---	---
	1-8	Loam	CL, CL-ML, SM	A-4	0	0-7	79-100	78-100	68-100	47-78	20-43	4-17
	8-20	Gravelly loam, loam, fine sandy loam	CL-ML	A-1, A-2, A-4	0	0-12	56-100	55-100	47-100	33-80	20-43	4-18
	20-61	Gravelly loam, loam, clay loam, silty clay loam, sandy clay loam	CL	A-4, A-2, A-6	0	0-12	56-100	55-100	48-100	35-85	24-46	9-24
	61-102	Loam, clay loam, silty clay loam, sandy clay loam, gravelly loam	CL	A-4, A-2, A-6	0	0-12	56-100	55-100	47-100	34-80	27-44	12-25
	102-128	Clay loam, loam, sandy clay loam, silty clay loam, gravelly loam, very cobbly clay loam	CL	A-4, A-1, A-6	0	0-40	45-100	42-100	37-100	27-80	27-44	12-25
	128-200	Very cobbly clay loam, clay loam, loam, sandy clay loam, clay, gravelly loam	CL	A-4, A-1, A-6, A-7	0-17	0-52	45-100	43-100	36-100	25-93	24-57	9-36

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>250 mm	75-250 mm	4	10	40	200		
	Cm				Pct	Pct					Pct	
CwC:												
Cottonbend------	0-1	Slightly decomposed plant material	---	---	0	0	---	---	---	---	---	---
	1-8	Loam	CL, CL-ML, SM	A-4	0	0-7	79-100	78-100	68-100	47-78	20-43	4-17
	8-20	Gravelly loam, loam, fine sandy loam	CL-ML	A-1, A-2, A-4	0	0-12	56-100	55-100	47-100	33-80	20-43	4-18
	20-61	Gravelly loam, loam, clay loam, silty clay loam, sandy clay loam	CL	A-4, A-2, A-6	0	0-12	56-100	55-100	48-100	35-85	24-46	9-24
	61-102	Loam, clay loam, silty clay loam, sandy clay loam, gravelly loam	CL	A-4, A-2, A-6	0	0-12	56-100	55-100	47-100	34-80	27-44	12-25
	102-128	Clay loam, loam, sandy clay loam, silty clay loam, gravelly loam, very cobbly clay loam	CL	A-4, A-1, A-6	0	0-40	45-100	42-100	37-100	27-80	27-44	12-25
	128-200	Very cobbly clay loam, clay loam, loam, sandy clay loam, clay, gravelly loam	CL	A-4, A-1, A-6, A-7	0-17	0-52	45-100	43-100	36-100	25-93	24-57	9-36
DkC:												
Dekalb----------	0-1	Slightly decomposed plant material	PT	A-8	25-43	0	---	---	---	---	---	---
	1-3	Moderately decomposed plant material	PT	A-8	24-42	0	---	---	---	---	---	---
	3-8	Highly organic very channery sandy loam, channery highly organic loam, very channery sandy loam	GM, ML, SM	A-2-5, A-2-4, A-5	0	12-36	65-95	30-91	24-80	14-52	33-69	1-8
	8-20	Very channery sandy loam, channery loam	SM, ML, GM	A-2-4, A-2-5, A-5	0	11-33	64-92	30-92	24-83	14-56	21-43	2-11
	20-65	Very channery loam, channery loam, very channery sandy loam	GC, GM, SM, ML	A-4, A-2-4	0-8	4-40	64-91	32-91	24-84	16-60	18-35	2-13
	65-80	Very channery sandy loam, very flaggy loamy sand, extremely channery loam	SC, SM, GC, GM	A-2-4, A-4	4-20	19-63	57-88	9-88	7-80	5-55	17-32	2-12
	80-90	Bedrock	---	---	---	---	---	---	---	---	---	---

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
DrE:												
Dekalb----------	0-1	Slightly decomposed plant material	PT	A-8	25-43	0	---	---	---	---	---	---
	1-3	Moderately decomposed plant material	PT	A-8	24-42	0	---	---	---	---	---	---
	3-8	Highly organic very channery sandy loam, channery highly organic loam, very channery sandy loam	SM, GM, ML	A-2-5, A-2-4, A-5	0	12-36	65-95	30-91	24-80	14-52	33-69	1-8
	8-20	Very channery sandy loam, channery loam	SM, ML, GM	A-2-4, A-2-5, A-5	0	11-33	64-92	30-92	24-83	14-56	21-43	2-11
	20-65	Very channery loam, channery loam, very channery sandy loam	GC, GM, SM, ML	A-4, A-2-4	0-8	4-40	64-91	32-91	24-84	16-60	18-35	2-13
	65-80	Very channery sandy loam, very flaggy loamy sand, extremely channery loam	SM, GM, SC, GC	A-2-4, A-4	4-20	19-63	57-88	9-88	7-80	5-55	17-32	2-12
	80-90	Bedrock	---	---	---	---	---	---	---	---	---	---
Rock outcrop.												
FeB:												
Fenwick---------	0-3	Moderately decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	3-8	Silt loam	MH, ML, CL-ML, SM	A-7-5, A-4	0	0-13	85-100	64-100	54-100	45-88	29-80	6-17
	8-23	Silt loam, loam	CL-ML, ML, SM	A-4	0	0-13	85-100	65-100	54-100	45-86	20-35	2-10
	23-66	Loam, silt loam, clay loam	CL, CL-ML, ML, SC	A-4, A-6	0	0-10	88-100	68-100	58-100	45-81	30-46	13-24
	66-86	Loam, silt loam, clay loam	CL, SC, CL-ML, ML	A-6, A-4, A-2-4	0	0-13	74-100	45-100	38-100	28-80	28-46	12-24
	86-99	Loam, silt loam, channery loam, channery sandy loam	CL, SC, CL-ML, ML	A-4, A-6, A-2-4	0	0-12	75-100	47-100	39-98	27-72	25-35	4-12
	99-109	Bedrock	---	---	---	---	---	---	---	---	---	---

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
FeC:												
Fenwick---------	0-3	Moderately decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	3-8	Silt loam	MH, ML, CL-ML, SM	A-7-5, A-4	0	0-13	85-100	64-100	54-100	45-88	29-80	6-17
	8-23	Silt loam, loam	CL-ML, ML, SM	A-4	0	0-13	85-100	65-100	54-100	45-86	20-35	2-10
	23-66	Loam, silt loam, clay loam	CL, CL-ML, ML, SC	A-4, A-6	0	0-10	88-100	68-100	58-100	45-81	30-46	13-24
	66-86	Loam, silt loam, clay loam	CL, SC, CL-ML, ML	A-6, A-4, A-2-4	0	0-13	74-100	45-100	38-100	28-80	28-46	12-24
	86-99	Loam, silt loam, channery loam, channery sandy loam	CL, SC, CL-ML, ML	A-4, A-6, A-2-4	0	0-12	75-100	47-100	39-98	27-72	25-35	4-12
	99-109	Bedrock	---	---	---	---	---	---	---	---	---	---
HgE:												
Highsplint------	0-3	Slightly decomposed plant material	PT	A-8	1-25	0	---	---	---	---	---	---
	3-18	Channery loam, very channery silt loam	GM, ML	A-7-6, A-2-4, A-2-7	0-3	0-17	52-87	36-81	31-80	23-63	33-56	9-18
	18-27	Channery loam, very channery silt loam	GC, GM, ML, CL	A-6, A-2-4, A-2-6	0	7-31	61-86	43-79	36-77	28-61	27-42	9-18
	27-108	Very channery loam, very channery silt loam, very channery clay loam	GC, SC, CL	A-6, A-2-6, A-2-4, A-4	0	6-27	37-80	24-72	20-72	16-58	24-42	9-21
	108-135	Very channery loam, very channery silt loam	GC, SC	A-2-6, A-2-4, A-4	0	11-34	27-68	14-64	12-63	9-49	24-37	9-18
	135-165	Extremely channery loam, extremely channery fine sandy loam, very channery silt loam	GC, SC, CL	A-2-6, A-2-4, A-4	0-43	11-45	26-82	12-79	10-77	7-57	24-38	9-18

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >250 mm	Fragments 75-250 mm	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
LaC:												
Laidig	0-2	Stony slightly decomposed plant material	PT	A-8	45-85	11-31	---	---	---	---	---	---
	2-9	Very gravelly loam, silt loam, gravelly highly organic loam	SM, GM, ML	A-2-5, A-4, A-5	0	0-14	39-89	30-87	23-83	16-62	0-69	NP-13
	9-19	Very gravelly loam, silt loam, gravelly loam	CL, GM, SM, CL-ML	A-6, A-4, A-2-6	0	0-12	47-91	39-89	33-88	24-69	26-44	7-17
	19-80	Very gravelly loam, silt loam, gravelly loam	CL, CL-ML, SC	A-6, A-4, A-2-6	0	0-13	56-97	44-95	36-92	27-73	23-38	7-18
	80-122	Very gravelly clay loam, silt loam, gravelly loam, gravelly silt loam	CL, CL-ML, SC	A-6, A-4, A-2-6	0	0-10	50-92	42-91	35-91	26-74	25-44	9-24
	122-200	Gravelly loam, loam, very gravelly sandy loam, very gravelly clay loam	SC, CL, CL-ML	A-6, A-4, A-2-6	0-13	0-31	44-93	32-90	26-90	18-69	22-40	6-21
LbC:												
Laidig	0-2	Extremely bouldery slightly decomposed plant material	PT	A-8	85-99	0	---	---	---	---	---	---
	2-9	Silt loam, gravelly highly organic loam, very gravelly loam	SM, GM, ML	A-2-5, A-4, A-5	0	0-14	39-89	30-87	23-83	16-62	0-69	NP-13
	9-19	Silt loam, gravelly loam, very gravelly loam	CL, GM, SM, CL-ML	A-6, A-4, A-2-6	0	0-12	47-91	39-89	33-88	24-69	26-44	7-17
	19-80	Silt loam, gravelly loam, very gravelly loam	CL, CL-ML, SC	A-6, A-4, A-2-6	0	0-13	56-97	44-95	36-92	27-73	23-38	7-18
	80-122	Gravelly silt loam, very gravelly clay loam, silt loam, gravelly loam	CL, CL-ML, SC	A-6, A-4, A-2-6	0	0-10	50-92	42-91	35-91	26-74	25-44	9-24
	122-200	Loam, gravelly loam, very gravelly sandy loam, very gravelly clay loam	SC, CL, CL-ML	A-6, A-4, A-2-6	0-13	0-31	44-93	32-90	26-90	18-69	22-40	6-21

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
LcE:												
Laidig----------	0-2	Slightly decomposed plant material	PT	A-8	1-25	0	---	---	---	---	---	---
	2-9	Very gravelly loam, silt loam, gravelly highly organic loam	SM, GM, ML	A-2-5, A-4, A-5	0	0-14	39-89	30-87	23-83	16-62	0-69	NP-13
	9-19	Very gravelly loam, silt loam, gravelly loam	CL, GM, SM, CL-ML	A-6, A-4, A-2-6	0	0-12	47-91	39-89	33-88	24-69	26-44	7-17
	19-80	Very gravelly loam, silt loam, gravelly loam	CL, CL-ML, SC	A-6, A-4, A-2-6	0	0-13	56-97	44-95	36-92	27-73	23-38	7-18
	80-122	Very gravelly clay loam, gravelly silt loam, gravelly loam	CL, CL-ML, SC	A-6, A-4, A-2-6	0	0-10	50-92	42-91	35-91	26-74	25-44	9-24
	122-200	Gravelly loam, very gravelly clay loam, very gravelly sandy loam	SC, CL, CL-ML	A-6, A-4, A-2-6	0-13	0-31	44-93	32-90	26-90	18-69	22-40	6-21
Clifftop--------	0-3	Slightly decomposed plant material	PT	A-8	1-20	0-5	---	---	---	---	---	---
	3-8	Channery silt loam	ML, CL, GC, GM	A-4, A-2	0	0-57	64-100	27-100	21-97	17-80	25-36	5-10
	8-20	Silt loam, channery silt loam, channery loam	ML, CL	A-6, A-4	0	0-4	81-94	63-94	55-90	45-75	27-43	9-12
	20-74	Channery silty clay loam, channery silt loam, channery loam, silty clay loam	GC-GM, SC, CL, CL-ML	A-5, A-4, A-7	0	0-24	69-96	39-96	34-96	30-89	20-45	4-15
	74-91	Very channery silty clay loam, very channery silt loam, channery loam, channery silty clay	GC-GM, GC	A-4, A-6, A-1, A-2	0	0-23	48-71	24-71	20-71	18-70	20-40	4-15
	91-101	Bedrock	---	---	---	---	---	---	---	---	---	---

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
LdF:												
Layland---------	0-3	Slightly decomposed plant material	PT	A-8	1-25	0	---	---	---	---	---	---
	3-5	Moderately decomposed plant material	PT	A-8	1-24	0	---	---	---	---	---	---
	5-15	Gravelly loam, very gravelly loam, silt loam	SM, GM, ML	A-2-5, A-7-5	0	0-38	20-90	17-90	15-90	11-69	42-78	10-12
	15-23	Gravelly loam, very gravelly loam, silt loam	SC, GC, ML	A-6, A-2-6	0	0-37	22-92	20-91	18-91	13-72	31-40	11-14
	23-117	Gravelly loam, very gravelly loam, silt loam	SC, GC	A-6, A-2-6	0-35	0-45	25-93	23-93	20-93	15-72	28-39	12-18
	117-145	Very gravelly loam, gravelly silt loam, extremely flaggy clay loam, extremely channery silty clay loam	SC, GC	A-6, A-2-6	4-60	23-93	11-79	8-78	7-78	5-65	27-38	11-20
	145-200	Very gravelly loam, gravelly silt loam, extremely flaggy clay loam, extremely channery silty clay loam	SC, GC	A-6, A-2-6	4-60	23-93	11-79	8-78	7-78	5-65	27-38	11-20
Clifftop--------	0-3	Slightly decomposed plant material	PT	A-8	1-25	0	---	---	---	---	---	---
	3-8	Channery silt loam	ML, CL, GC, GM	A-4, A-2	0	0-57	64-100	27-100	21-97	17-80	25-36	5-10
	8-20	Silt loam, channery silt loam, channery loam	ML, CL	A-6, A-4	0	0-5	81-94	63-94	55-90	45-75	27-43	9-12
	20-74	Channery silty clay loam, channery silt loam, channery loam, silty clay loam	GC-GM, SC, CL, CL-ML	A-5, A-4, A-7	0	0-24	69-96	39-96	34-96	30-89	20-45	4-15
	74-91	Very channery silty clay loam, very channery silt loam, channery loam, channery silty clay	GC-GM, GC	A-4, A-6, A-1, A-2	0	0-23	48-71	24-71	20-71	18-70	20-40	4-15
	91-101	Bedrock	---	---	---	---	---	---	---	---	---	---

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
LhE:												
Layland---------	0-3	Stony slightly decomposed plant material	PT	A-8	45-85	0	---	---	---	---	---	---
	3-5	Stony moderately decomposed plant material	PT	A-8	44-84	0	---	---	---	---	---	---
	5-15	Gravelly loam, very gravelly loam, silt loam	SM, GM, ML	A-2-5, A-7-5	0	0-38	20-90	17-90	15-90	11-69	42-78	10-12
	15-23	Gravelly loam, very gravelly loam, silt loam	SC, GC, ML	A-6, A-2-6	0	0-37	22-92	20-91	18-91	13-72	31-40	11-14
	23-117	Gravelly loam, very gravelly loam, silt loam	SC, GC	A-6, A-2-6	0-35	0-45	25-93	23-93	20-93	15-72	28-39	12-18
	117-145	Very gravelly loam, gravelly silt loam, extremely flaggy clay loam, extremely channery silty clay loam	SC, GC	A-6, A-2-6	4-60	23-93	11-79	8-78	7-78	5-65	27-38	11-20
	145-200	Very gravelly loam, gravelly silt loam, extremely flaggy clay loam, extremely channery silty clay loam	SC, GC	A-6, A-2-6	4-60	23-93	11-79	8-78	7-78	5-65	27-38	11-20

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
LhE:												
Laidig----------	0-2	Stony slightly decomposed plant material	PT	A-8	45-85	0	---	---	---	---	---	---
	2-9	Very gravelly loam, silt loam, gravelly highly organic loam	SM, GM, ML	A-2-5, A-4, A-5	0	0-14	39-89	30-87	23-83	16-62	0-69	NP-13
	9-19	Very gravelly loam, silt loam, gravelly loam	CL, GM, SM, CL-ML	A-6, A-4, A-2-6	0	0-12	47-91	39-89	33-88	24-69	26-44	7-17
	19-80	Very gravelly loam, silt loam, gravelly loam	CL, CL-ML, SC	A-6, A-4, A-2-6	0	0-13	56-97	44-95	36-92	27-73	23-38	7-18
	80-122	Very gravelly clay loam, gravelly silt loam, gravelly loam	CL, CL-ML, SC	A-6, A-4, A-2-6	0	0-10	50-92	42-91	35-91	26-74	25-44	9-24
	122-200	Gravelly loam, very gravelly clay loam, very gravelly sandy loam	SC, CL, CL-ML	A-6, A-4, A-2-6	0-13	0-31	44-93	32-90	26-90	18-69	22-40	6-21

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
LkE:												
Layland---------	0-3	Extremely bouldery slightly decomposed plant material	PT	A-8	85-99	0	---	---	---	---	---	---
	3-5	Extremely bouldery moderately decomposed plant material	PT	A-8	84-99	0	---	---	---	---	---	---
	5-15	Gravelly loam, very gravelly loam, silt loam	SM, GM, ML	A-2-5, A-7-5	0	0-38	20-90	17-90	15-90	11-69	42-78	10-12
	15-23	Gravelly loam, very gravelly loam, silt loam	SC, GC, ML	A-2-6, A-6	0	0-37	22-92	20-91	18-91	13-72	31-40	11-14
	23-117	Gravelly loam, very gravelly loam, silt loam	SC, GC	A-6, A-2-6	0-35	0-45	25-93	23-93	20-93	15-72	28-39	12-18
	117-145	Very gravelly loam, gravelly silt loam, extremely flaggy clay loam, extremely channery silty clay loam	SC, GC	A-6, A-2-6	4-60	23-93	11-79	8-78	7-78	5-65	27-38	11-20
	145-200	Very gravelly loam, gravelly silt loam, extremely flaggy clay loam, extremely channery silty clay loam	SC, GC	A-2-6, A-6	4-60	23-93	11-79	8-78	7-78	5-65	27-38	11-20
Laidig----------	0-2	Extremely bouldery slightly decomposed plant material	PT	A-8	85-99	0	---	---	---	---	---	---
	2-9	Gravelly highly organic loam, very gravelly loam, silt loam	SM, GM, ML	A-2-5, A-4, A-5	0	0-14	39-89	30-87	23-83	16-62	0-69	NP-13
	9-19	Gravelly loam, very gravelly loam, silt loam	CL, GM, SM, CL-ML	A-6, A-4, A-2-6	0	0-12	47-91	39-89	33-88	24-69	26-44	7-17
	19-80	Gravelly loam, very gravelly loam, silt loam	CL, CL-ML, SC	A-6, A-4, A-2-6	0	0-13	56-97	44-95	36-92	27-73	23-38	7-18
	80-122	Gravelly loam, very gravelly clay loam, gravelly silt loam	CL, CL-ML, SC	A-6, A-4, A-2-6	0	0-10	50-92	42-91	35-91	26-74	25-44	9-24
	122-200	Very gravelly sandy loam, gravelly loam, very gravelly clay loam	SC, CL, CL-ML	A-6, A-4, A-2-6	0-13	0-31	44-93	32-90	26-90	18-69	22-40	6-21

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
LmF:												
Layland	0-3	Extremely bouldery slightly decomposed plant material	PT	A-8	85-99	0	---	---	---	---	---	---
	3-5	Extremely bouldery moderately decomposed plant material	PT	A-8	84-99	0	---	---	---	---	---	---
	5-15	Gravelly loam, very gravelly loam, silt loam	SM, GM, ML	A-2-5, A-7-5	0	0-38	20-90	17-90	15-90	11-69	42-78	10-12
	15-23	Gravelly loam, very gravelly loam, silt loam	SC, GC, ML	A-6, A-2-6	0	0-37	22-92	20-91	18-91	13-72	31-40	11-14
	23-117	Gravelly loam, very gravelly loam, silt loam	SC, GC	A-6, A-2-6	0-35	0-45	25-93	23-93	20-93	15-72	28-39	12-18
	117-145	Very gravelly loam, gravelly silt loam, extremely flaggy clay loam, extremely channery silty clay loam	SC, GC	A-6, A-2-6	4-60	23-93	11-79	8-78	7-78	5-65	27-38	11-20
	145-200	Very gravelly loam, gravelly silt loam, extremely flaggy clay loam, extremely channery silty clay loam	SC, GC	A-6, A-2-6	4-60	23-93	11-79	8-78	7-78	5-65	27-38	11-20
Rock outcrop.												
LuC:												
Lithic Udorthents, leveled land	0-10	Gravelly sandy loam, very gravelly clay loam, very gravelly loam, extremely channery silt loam	---	---	---	---	---	---	---	---	---	---
	10-22	Gravelly sandy loam, very gravelly clay loam, extremely channery silt loam, extremely channery loam	---	---	---	---	---	---	---	---	---	---
	22-32	Bedrock	---	---	---	---	---	---	---	---	---	---

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
LxG:												
Lithic Udorthents, cut land-------	0-10	Gravelly sandy loam, very gravelly clay loam, very gravelly loam, extremely channery silt loam	---	---	---	---	---	---	---	---	---	---
	10-22	Gravelly sandy loam, very gravelly clay loam, extremely channery silt loam, extremely channery loam	---	---	---	---	---	---	---	---	---	---
	22-32	Bedrock	---	---	---	---	---	---	---	---	---	---
Rock outcrop.												
NaB:												
Nallen----------	0-3	Slightly decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	3-4	Moderately decomposed plant material	PT	A-8	0	0-7	---	---	---	---	---	---
	4-13	Loam	ML, SM, CL-ML	A-5, A-4	0	0-7	88-100	71-100	62-100	36-71	29-54	5-11
	13-23	Channery sandy loam, loam, fine sandy loam	ML, CL, SC, SM	A-5, A-4	0	0-13	85-100	70-100	60-100	38-73	22-44	4-14
	23-48	Channery sandy loam, loam, fine sandy loam	CL, SC, SC-SM	A-4, A-6	0	0-12	86-100	72-100	61-100	36-70	21-34	5-14
	48-86	Channery sandy loam, loam, very channery fine sandy loam	GC, GC-GM, CL	A-4, A-2-4, A-1-b	0	2-38	70-97	41-96	32-96	15-53	16-28	2-12
	86-96	Bedrock	---	---	---	---	---	---	---	---	---	---
NaC:												
Nallen----------	0-3	Slightly decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	3-4	Moderately decomposed plant material	PT	A-8	0	0-7	---	---	---	---	---	---
	4-13	Loam	ML, SM, CL-ML	A-5, A-4	0	0-7	88-100	71-100	62-100	36-71	29-54	5-11
	13-23	Channery sandy loam, loam, fine sandy loam	ML, CL, SC, SM	A-5, A-4	0	0-13	85-100	70-100	60-100	38-73	22-44	4-14
	23-48	Channery sandy loam, loam, fine sandy loam	CL, SC, SC-SM	A-4, A-6	0	0-12	86-100	72-100	61-100	36-70	21-34	5-14
	48-86	Channery sandy loam, loam, very channery fine sandy loam	GC, GC-GM, CL	A-4, A-2-4, A-1-b	0	2-38	70-97	41-96	32-96	15-53	16-28	2-12
	86-96	Bedrock	---	---	---	---	---	---	---	---	---	---

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	Percentage passing sieve number--: 10	Percentage passing sieve number--: 40	Percentage passing sieve number--: 200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
NaD:												
Nallen----------	0-3	Slightly decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	3-4	Moderately decomposed plant material	PT	A-8	0	0-7	---	---	---	---	---	---
	4-13	Loam	ML, SM, CL-ML	A-4, A-5	0	0-7	88-100	71-100	62-100	36-71	29-54	5-11
	13-23	Channery sandy loam, loam, fine sandy loam	ML, CL, SC, SM	A-4, A-5	0	0-13	85-100	70-100	60-100	38-73	22-44	4-14
	23-48	Channery sandy loam, loam, fine sandy loam	SC, SC-SM, CL	A-4, A-6	0	0-12	86-100	72-100	61-100	36-70	21-34	5-14
	48-86	Channery sandy loam, loam, very channery fine sandy loam	GC, GC-GM, CL	A-4, A-2-4, A-1-b	0	2-38	70-97	41-96	32-96	15-53	16-28	2-12
	86-96	Bedrock	---	---	---	---	---	---	---	---	---	---
PsA:												
Pope, rarely flooded--------	0-3	Slightly decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	3-5	Moderately decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	5-18	Sandy loam	SC-SM, SM, CL-ML, ML	A-4, A-2	0	0	87-100	63-100	43-88	20-52	15-20	NP-5
	18-81	Fine sandy loam, sandy loam, loam	SM, CL-ML, ML, SC-SM	A-4, A-2	0	0	95-100	77-100	50-92	22-56	15-30	NP-7
	81-200	Very gravelly sandy loam, loamy sand	SM, SC-SM, GM	A-4, A-2, A-1	0	0-12	61-100	14-100	10-87	4-49	15-30	NP-7
PvA:												
Pope, occasionally flooded--------	0-3	Slightly decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	3-5	Moderately decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	5-18	Sandy loam	SC-SM, SM, CL-ML, ML	A-4, A-2	0	0	87-100	63-100	43-88	20-52	15-20	NP-5
	18-81	Fine sandy loam, sandy loam, loam	SM, CL-ML, ML, SC-SM	A-4, A-2	0	0	95-100	77-100	50-92	22-56	15-30	NP-7
	81-200	Very gravelly sandy loam, loamy sand	SM, SC-SM, GM	A-4, A-2, A-1	0	0-12	61-100	14-100	10-87	4-49	15-30	NP-7

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	Percentage passing sieve number--: 10	Percentage passing sieve number--: 40	Percentage passing sieve number--: 200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
PvA:												
Craigsville, occasionally flooded--------	0-5	Slightly decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	5-8	Moderately decomposed plant material	PT	A-8	0	0	---	---	---	---	---	---
	8-21	Very gravelly loam, very gravelly sandy loam	SM, SC	A-2-4, A-1-a, A-4	0	0-8	58-92	16-84	11-73	5-42	0-41	NP-13
	21-60	Extremely gravelly loam, very gravelly sandy loam	SM, SC, GM	A-2-4, A-1-a	0	0-7	56-74	12-54	8-47	4-27	0-35	NP-13
	60-200	Extremely gravelly sandy loam, extremely gravelly loamy coarse sand	SM, GM, GC	A-2-4, A-1-a	0	0-14	54-74	8-54	4-35	1-17	0-30	NP-10
Rw.												
Riverwash, frequently flooded												
ThB:												
Typic Haplorthods, rarely flooded-	0-2	Stony slightly decomposed plant material	PT	A-8	45-85	0	---	---	---	---	---	---
	2-4	Stony moderately decomposed plant material	PT	A-8	24-42	24-58	---	---	---	---	---	---
	4-13	Highly organic sandy loam	SC-SM, SM, CL-ML, ML	A-4, A-2	0	0	87-100	63-100	45-88	21-52	15-20	NP-5
	13-33	Loamy sand, gravelly sandy loam, very cobbly sand	SC, GC, SM, SP	A-3, A-2, A-1	0-20	0-21	61-100	9-100	7-85	2-32	0-25	NP-7
	33-43	Gravelly loamy sand, sandy loam, very cobbly sandy loam	SP, SM	A-3, A-2, A-1	0-27	0-28	74-100	39-100	26-78	8-32	0-59	NP-7
	43-92	Very bouldery loamy sand, cobbly sandy loam, extremely stony sandy loam	SM, SP-SM, GP, GW	A-3, A-2, A-1	7-98	7-32	63-91	13-91	10-78	2-18	0-35	NP-6
	92-165	Very bouldery sand, very cobbly sand, extremely stony loamy sand	SM, SP-SM, GP, GW	A-3, A-2, A-1-b	27-94	6-31	61-88	7-88	6-78	2-29	0-23	NP-6

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>250 mm	75-250 mm	4	10	40	200		
	Cm				Pct	Pct					Pct	
UgC:												
Udorthents, graded---------	0-4	Gravelly sandy loam, very gravelly clay loam, very channery silt loam, extremely channery loam	---	---	---	---	---	---	---	---	---	---
	4-27	Gravelly sandy loam, very gravelly clay loam, very channery silt loam, extremely channery loam	---	---	---	---	---	---	---	---	---	---
	27-165	Gravelly sandy loam, very gravelly clay loam, extremely channery silt loam, extremely channery loam	---	---	---	---	---	---	---	---	---	---
UgF:												
Udorthents, graded---------	0-4	Gravelly sandy loam, very gravelly clay loam, very channery silt loam, extremely channery loam	---	---	---	---	---	---	---	---	---	---
	4-27	Gravelly sandy loam, very gravelly clay loam, very channery silt loam, extremely channery loam	---	---	---	---	---	---	---	---	---	---
	27-165	Gravelly sandy loam, very gravelly clay loam, extremely channery silt loam, extremely channery loam	---	---	---	---	---	---	---	---	---	---
Ur.												
Udorthents, railroad grade												

Table 20.—Engineering Properties—Continued

Map unit symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >250 mm	Fragments: 75-250 mm	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	Cm				Pct	Pct					Pct	
Uu:												
Udorthents, highways-------	0-4	Gravelly sandy loam, very gravelly clay loam, very channery silt loam, extremely channery loam	---	---	---	---	---	---	---	---	---	---
	4-27	Gravelly sandy loam, very gravelly clay loam, very channery silt loam, extremely channery loam	---	---	---	---	---	---	---	---	---	---
	27-165	Gravelly sandy loam, very gravelly clay loam, extremely channery silt loam, extremely channery loam	---	---	---	---	---	---	---	---	0-35	NP-18
Urban land, highways.												
W. Water												
Wr. Water-Rubble land												

Table 21.—Physical Soil Properties

(Sand, silt, and clay values are shown either as a range or as a representative value. Absence of an entry indicates that data were not estimated. Soil properties are measured or inferred from direct observations in the field or laboratory)

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	Cm	Pct	Pct	Pct	g/cc	um/sec	Cm/cm	Pct	Pct
AgC:									
Allegheny-------	0-1	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	1-4	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	4-26	30-50	30-50	15-27	1.20-1.40	4.2-14.1	0.08-0.22	0.0-2.9	1.0-4.0
	26-42	30-50	30-50	15-27	1.20-1.40	4.2-14.1	0.08-0.22	0.0-2.9	0.5-2.0
	42-165	30-55	20-45	18-38	1.20-1.50	1.4-14.1	0.13-0.18	0.0-2.9	0.0-0.5
BhG:									
Berks-----------	0-2	0-0		0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	2-19	8-32	42-76	14-23	0.75-1.25	4.0-42.0	0.08-0.12	0.5-2.9	5.5-11
	19-28	11-43	42-72	14-23	1.00-1.30	4.0-42.0	0.08-0.12	0.5-2.1	1.5-5.0
	28-76	8-37	46-75	15-23	1.30-1.60	4.0-42.0	0.04-0.10	0.2-1.6	0.5-2.2
	76-98	5-30	46-75	17-26	1.30-1.70	14.0-42.0	0.04-0.10	0.2-1.2	0.2-1.2
	98-108	---	---	---	---	0.0-141.0	---	---	---
Highsplint------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-18	22-53	35-53	14-27	1.04-1.12	14.1-141.1	0.09-0.16	1.3-2.7	3.9-9.5
	18-27	21-51	37-55	14-27	1.10-1.49	14.1-42.3	0.09-0.16	0.5-2.1	1.5-3.0
	27-108	22-53	36-55	14-30	1.25-1.68	4.2-14.1	0.08-0.12	0.2-2.2	0.3-1.7
	108-135	28-55	34-53	14-27	1.25-1.70	4.2-14.1	0.07-0.12	0.3-1.3	0.3-0.9
	135-165	27-61	23-54	14-27	1.37-1.80	4.2-14.1	0.04-0.11	0.3-1.3	0.2-1.0
Sharondale------	0-5	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	5-38	24-56	24-49	15-34	0.77-1.19	14.1-42.3	0.06-0.17	2.0-4.1	2.8-12
	38-51	25-55	32-50	14-30	1.17-1.34	14.1-42.3	0.06-0.17	0.8-1.3	1.0-5.3
	51-160	17-60	29-55	9-28	1.19-1.53	14.1-42.3	0.05-0.14	0.4-1.8	0.5-4.3
	160-218	15-52	37-56	12-29	1.22-1.66	14.1-42.3	0.05-0.12	0.5-1.8	0.3-3.0
	218-228	---	---	---	---	0.4-14.1	---	---	---
BuC:									
Buchanan--------	0-3	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	3-20	43-85	0-50	0-20	1.20-1.40	4.0-14.0	0.14-0.20	0.0-2.9	1.0-3.0
	20-53	0-80	0-88	0-35	1.30-1.60	4.0-14.0	0.10-0.16	0.0-2.9	0.0-0.5
	53-152	0-80	0-88	0-35	1.30-1.60	0.4-1.4	0.10-0.16	0.0-2.9	0.0-0.5
	152-165	20-85	0-53	0-40	1.40-1.70	1.4-4.2	0.06-0.10	0.0-2.9	0.0-0.5

Table 21.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	Cm	Pct	Pct	Pct	g/cc	um/sec	Cm/cm	Pct	Pct
ClB:									
Clifftop--------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-8	12-45	35-65	5-23	0.80-1.27	4.0-42.0	0.13-0.18	1.4-3.3	3.5-27
	8-20	10-42	35-65	14-23	1.11-1.56	4.0-42.0	0.11-0.18	0.4-3.0	0.4-4.3
	20-74	5-40	35-65	20-35	1.19-1.59	4.0-14.0	0.11-0.18	0.5-3.0	0.3-1.7
	74-91	5-30	35-65	20-42	1.39-1.65	2.8-14.0	0.08-0.13	0.7-3.0	0.3-0.8
	91-101	---	---	---	---	0.4-14.1	---	---	---
ClC:									
Clifftop--------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-8	12-45	35-65	5-23	0.80-1.27	4.0-42.0	0.13-0.18	1.4-3.3	3.5-27
	8-20	10-42	35-65	14-23	1.11-1.56	4.0-42.0	0.11-0.18	0.4-3.0	0.4-4.3
	20-74	5-40	35-65	20-35	1.19-1.59	4.0-14.0	0.11-0.18	0.5-3.0	0.3-1.7
	74-91	5-30	35-65	20-42	1.39-1.65	2.8-14.0	0.08-0.13	0.7-3.0	0.3-0.8
	91-101	---	---	---	---	0.4-14.1	---	---	---
ClD:									
Clifftop--------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-8	12-45	35-65	5-23	0.80-1.27	4.0-42.0	0.13-0.18	1.4-3.3	3.5-27
	8-20	10-42	35-65	14-23	1.11-1.56	4.0-42.0	0.11-0.18	0.4-3.0	0.4-4.3
	20-74	5-40	35-65	20-35	1.19-1.59	4.0-14.0	0.11-0.18	0.5-3.0	0.3-1.7
	74-91	5-30	35-65	20-42	1.39-1.65	2.8-14.0	0.08-0.13	0.7-3.0	0.3-0.8
	91-101	---	---	---	---	0.4-14.1	---	---	---
ClE:									
Clifftop--------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-8	12-45	35-65	5-23	0.80-1.27	4.0-42.0	0.13-0.18	1.4-3.3	3.5-27
	8-20	10-42	35-65	14-23	1.11-1.56	4.0-42.0	0.11-0.18	0.4-3.0	0.4-4.3
	20-74	5-40	35-65	20-35	1.19-1.59	4.0-14.0	0.11-0.18	0.5-3.0	0.3-1.7
	74-91	5-30	35-65	20-42	1.39-1.65	2.8-14.0	0.08-0.13	0.7-3.0	0.3-0.8
	91-99	---	---	---	---	0.4-14.1	---	---	---
CmC:									
Clifftop--------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-8	12-45	35-65	5-23	0.80-1.27	4.0-42.0	0.13-0.18	1.4-3.3	3.5-27
	8-20	10-42	35-65	14-23	1.11-1.56	4.0-42.0	0.11-0.18	0.4-3.0	0.4-4.3
	20-74	5-40	35-65	20-35	1.19-1.59	4.0-14.0	0.11-0.18	0.5-3.0	0.3-1.7
	74-91	5-30	35-65	20-42	1.39-1.65	2.8-14.0	0.08-0.13	0.7-3.0	0.3-0.8
	91-101	---	---	---	---	0.4-14.1	---	---	---

Table 21.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	Cm	Pct	Pct	Pct	g/cc	um/sec	Cm/cm	Pct	Pct
CwB:									
Cottonbend------	0-1	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	1-8	25-50	30-50	8-25	1.35-1.50	4.0-14.0	0.14-0.21	0.0-2.9	0.5-4.0
	8-20	25-65	15-50	8-27	1.40-1.55	4.0-14.0	0.09-0.19	0.0-2.9	0.5-3.0
	20-61	10-65	15-60	15-35	1.40-1.55	4.0-14.0	0.07-0.19	0.0-2.9	0.0-1.5
	61-102	10-65	15-60	18-35	1.40-1.55	4.0-14.0	0.07-0.19	0.0-2.9	0.0-0.5
	102-128	10-65	15-60	18-35	1.40-1.55	4.0-14.0	0.05-0.19	0.0-2.9	0.0-0.5
	128-200	10-65	15-50	15-50	1.40-1.60	4.0-14.0	0.05-0.19	0.0-2.9	0.0-0.5
CwC:									
Cottonbend------	0-1	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	1-8	25-50	30-50	8-25	1.35-1.50	4.0-14.0	0.14-0.21	0.0-2.9	0.5-4.0
	8-20	25-65	15-50	8-27	1.40-1.55	4.0-14.0	0.09-0.19	0.0-2.9	0.5-3.0
	20-61	10-65	15-60	15-35	1.40-1.55	4.0-14.0	0.07-0.19	0.0-2.9	0.0-1.5
	61-102	10-65	15-60	18-35	1.40-1.55	4.0-14.0	0.07-0.19	0.0-2.9	0.0-0.5
	102-128	10-65	15-60	18-35	1.40-1.55	4.0-14.0	0.05-0.19	0.0-2.9	0.0-0.5
	128-200	10-65	15-50	15-50	1.40-1.60	4.0-14.0	0.05-0.19	0.0-2.9	0.0-0.5
DkC:									
Dekalb----------	0-1	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	1-3	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	3-8	35-70	22-45	3-14	0.80-1.20	42.0-141.0	0.15-0.45	2.0-2.2	8.0-20
	8-20	35-70	24-46	5-18	1.10-1.20	42.0-141.0	0.08-0.12	0.5-1.4	2.0-7.0
	20-65	35-70	24-46	5-20	1.20-1.50	42.0-141.0	0.06-0.12	0.4-1.8	1.0-2.5
	65-80	35-90	16-44	5-18	1.20-1.50	42.0-141.0	0.05-0.10	0.4-1.3	0.3-2.0
	80-90	---	---	---	---	1.4-141.1	---	---	---
DrE:									
Dekalb----------	0-1	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	1-3	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	3-8	35-70	22-45	3-14	0.80-1.20	42.0-141.0	0.15-0.45	2.0-2.2	8.0-20
	8-20	35-70	24-46	5-18	1.10-1.20	42.0-141.0	0.08-0.12	0.5-1.4	2.0-7.0
	20-65	35-70	24-46	5-20	1.20-1.50	42.0-141.0	0.06-0.12	0.4-1.8	1.0-2.5
	65-80	35-90	16-44	5-18	1.20-1.50	42.0-141.0	0.05-0.10	0.4-1.3	0.3-2.0
	80-90	---	---	---	---	1.4-141.1	---	---	---

Table 21.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	Cm	Pct	Pct	Pct	g/cc	um/sec	Cm/cm	Pct	Pct
FeB:									
Fenwick---------	0-3	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	3-8	14-50	35-60	10-27	0.80-1.27	4.0-42.0	0.13-0.18	1.4-3.3	3.5-21
	8-23	14-50	35-60	10-27	1.01-1.21	4.0-42.0	0.12-0.16	0.4-3.0	3.0-6.0
	23-66	10-52	28-60	20-35	1.25-1.60	4.0-14.0	0.10-0.16	1.2-2.9	0.2-1.5
	66-86	10-52	28-60	18-35	1.25-1.60	1.4-4.0	0.10-0.16	1.2-2.9	0.2-1.5
	86-99	10-60	28-60	15-30	1.40-1.70	1.4-4.0	0.08-0.14	1.0-2.9	0.1-0.3
	99-109	---	---	---	---	0.0-4.2	---	---	---
FeC:									
Fenwick---------	0-3	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	3-8	14-50	35-60	10-27	0.80-1.27	4.0-42.0	0.13-0.18	1.4-3.3	3.5-21
	8-23	14-50	35-60	10-27	1.01-1.21	4.0-42.0	0.12-0.16	0.4-3.0	3.0-6.0
	23-66	10-52	28-60	20-35	1.25-1.60	4.0-14.0	0.10-0.16	1.2-2.9	0.2-1.5
	66-86	10-52	28-60	18-35	1.25-1.60	1.4-4.0	0.10-0.16	1.2-2.9	0.2-1.5
	86-99	10-60	28-60	15-30	1.40-1.70	1.4-4.0	0.08-0.14	1.0-2.9	0.1-0.3
	99-109	---	---	---	---	0.0-4.2	---	---	---
HgE:									
Highsplint------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-18	22-53	35-53	14-27	1.04-1.12	14.1-141.1	0.09-0.16	1.3-2.7	3.9-9.5
	18-27	21-51	37-55	14-27	1.10-1.49	14.1-42.3	0.09-0.16	0.5-2.1	1.5-3.0
	27-108	22-53	36-55	14-30	1.25-1.68	4.2-14.1	0.08-0.12	0.2-2.2	0.3-1.7
	108-135	28-55	34-53	14-27	1.25-1.70	4.2-14.1	0.07-0.12	0.3-1.3	0.3-0.9
	135-165	27-61	23-54	14-27	1.37-1.80	4.2-14.1	0.04-0.11	0.3-1.3	0.2-1.0
LaC:									
Laidig----------	0-2	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	2-9	23-50	34-59	1-21	0.80-1.20	14.0-42.0	0.15-0.45	0.2-1.0	4.4-18
	9-19	24-51	34-57	12-26	1.10-1.35	14.0-42.0	0.12-0.22	0.2-1.5	2.0-4.4
	19-80	20-51	36-56	12-27	1.35-1.60	4.2-14.0	0.09-0.17	0.2-2.0	0.3-0.8
	80-122	24-52	31-52	15-35	1.35-1.65	4.2-14.0	0.09-0.17	0.6-1.7	0.2-0.7
	122-200	24-63	25-50	11-31	1.55-1.80	0.4-1.4	0.03-0.12	0.3-1.4	0.2-0.3
LbC:									
Laidig----------	0-2	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	2-9	23-50	34-59	1-21	0.80-1.20	14.0-42.0	0.15-0.45	0.2-1.0	4.4-18
	9-19	24-51	34-57	12-26	1.10-1.35	14.0-42.0	0.12-0.22	0.2-1.5	2.0-4.4
	19-80	20-51	36-56	12-27	1.35-1.60	4.2-14.0	0.09-0.17	0.2-2.0	0.3-0.8
	80-122	24-52	31-52	15-35	1.35-1.65	4.2-14.0	0.09-0.17	0.6-1.7	0.2-0.7
	122-200	24-63	25-50	11-31	1.55-1.80	0.4-1.4	0.03-0.12	0.3-1.4	0.2-0.3

Table 21.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	Cm	Pct	Pct	Pct	g/cc	um/sec	Cm/cm	Pct	Pct
LcE:									
Laidig----------	0-2	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	2-9	23-50	34-59	1-21	0.80-1.20	14.0-42.0	0.15-0.45	0.2-1.0	4.4-18
	9-19	24-51	34-57	12-26	1.10-1.35	14.0-42.0	0.12-0.22	0.2-1.5	2.0-4.4
	19-80	20-51	36-56	12-27	1.35-1.60	4.2-14.0	0.09-0.17	0.2-2.0	0.3-0.8
	80-122	24-52	31-52	15-35	1.35-1.65	4.2-14.0	0.09-0.17	0.6-1.7	0.2-0.7
	122-200	24-63	25-50	11-31	1.55-1.80	0.4-1.4	0.03-0.12	0.3-1.4	0.2-0.3
Clifftop--------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-8	12-45	35-65	5-23	0.80-1.27	4.0-42.0	0.13-0.18	1.4-3.3	3.5-27
	8-20	10-42	35-65	14-23	1.11-1.56	4.0-42.0	0.11-0.18	0.4-3.0	0.4-4.3
	20-74	5-40	35-65	20-35	1.19-1.59	4.0-14.0	0.11-0.18	0.5-3.0	0.3-1.7
	74-91	5-30	35-65	20-42	1.39-1.65	2.8-14.0	0.08-0.13	0.7-3.0	0.3-0.8
	91-101	---	---	---	---	0.4-14.1	---	---	---
LdF:									
Layland---------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-5	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	5-15	28-43	36-54	16-20	1.04-1.07	14.1-42.3	0.08-0.18	1.9-2.7	7.0-22
	15-23	26-44	35-55	17-21	1.19-1.33	4.2-14.1	0.08-0.18	1.4-2.1	2.0-4.5
	23-117	23-45	34-53	18-26	1.43-1.66	4.2-14.1	0.08-0.18	0.4-2.1	0.2-1.6
	117-145	10-43	39-61	17-29	1.31-1.68	4.2-14.1	0.06-0.13	0.5-1.3	0.2-0.6
	145-200	10-43	39-61	17-29	1.31-1.68	4.2-14.1	0.06-0.13	0.5-1.3	0.1-0.5
Clifftop--------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-8	12-45	35-65	5-23	0.80-1.27	4.0-42.0	0.13-0.18	1.4-3.3	3.5-27
	8-20	10-42	35-65	14-23	1.11-1.56	4.0-42.0	0.11-0.18	0.4-3.0	0.4-4.3
	20-74	5-40	35-65	20-35	1.19-1.59	4.0-14.0	0.11-0.18	0.5-3.0	0.3-1.7
	74-91	5-30	35-65	20-42	1.39-1.65	2.8-14.0	0.08-0.13	0.7-3.0	0.3-0.8
	91-101	---	---	---	---	0.4-14.1	---	---	---
LhE:									
Layland---------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-5	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	5-15	28-43	36-54	16-20	1.04-1.07	14.1-42.3	0.08-0.18	1.9-2.7	7.0-22
	15-23	26-44	35-55	17-21	1.19-1.33	4.2-14.1	0.08-0.18	1.4-2.1	2.0-4.5
	23-117	23-45	34-53	18-26	1.43-1.66	4.2-14.1	0.08-0.18	0.4-2.1	0.2-1.6
	117-145	10-43	39-61	17-29	1.31-1.68	4.2-14.1	0.06-0.13	0.5-1.3	0.2-0.6
	145-200	10-43	39-61	17-29	1.31-1.68	4.2-14.1	0.06-0.13	0.5-1.3	0.1-0.5

Table 21.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	Cm	Pct	Pct	Pct	g/cc	um/sec	Cm/cm	Pct	Pct
LhE:									
Laidig----------	0-2	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	2-9	23-50	34-59	1-21	0.80-1.20	14.0-42.0	0.15-0.45	0.2-1.0	4.4-18
	9-19	24-51	34-57	12-26	1.10-1.35	14.0-42.0	0.12-0.22	0.2-1.5	2.0-4.4
	19-80	20-51	36-56	12-27	1.35-1.60	4.2-14.0	0.09-0.17	0.2-2.0	0.3-0.8
	80-122	24-52	31-52	15-35	1.35-1.65	4.2-14.0	0.09-0.17	0.6-1.7	0.2-0.7
	122-200	24-63	25-50	11-31	1.55-1.80	0.4-1.4	0.03-0.12	0.3-1.4	0.2-0.3
LkE:									
Layland---------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-5	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	5-15	28-43	36-54	16-20	1.04-1.07	14.1-42.3	0.08-0.18	1.9-2.7	7.0-22
	15-23	26-44	35-55	17-21	1.19-1.33	4.2-14.1	0.08-0.18	1.4-2.1	2.0-4.5
	23-117	23-45	34-53	18-26	1.43-1.66	4.2-14.1	0.08-0.18	0.4-2.1	0.2-1.6
	117-145	10-43	39-61	17-29	1.31-1.68	4.2-14.1	0.06-0.13	0.5-1.3	0.2-0.6
	145-200	10-43	39-61	17-29	1.31-1.68	4.2-14.1	0.06-0.13	0.5-1.3	0.1-0.5
Laidig----------	0-2	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	2-9	23-50	34-59	1-21	0.80-1.20	14.0-42.0	0.15-0.45	0.2-1.0	4.4-18
	9-19	24-51	34-57	12-26	1.10-1.35	14.0-42.0	0.12-0.22	0.2-1.5	2.0-4.4
	19-80	20-51	36-56	12-27	1.35-1.60	4.2-14.0	0.09-0.17	0.2-2.0	0.3-0.8
	80-122	24-52	31-52	15-35	1.35-1.65	4.2-14.0	0.09-0.17	0.6-1.7	0.2-0.7
	122-200	24-63	25-50	11-31	1.55-1.80	0.4-1.4	0.03-0.12	0.3-1.4	0.2-0.3
LmF:									
Layland---------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-5	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	5-15	28-43	36-54	16-20	1.04-1.07	14.1-42.3	0.08-0.18	1.9-2.7	7.0-22
	15-23	26-44	35-55	17-21	1.19-1.33	4.2-14.1	0.08-0.18	1.4-2.1	2.0-4.5
	23-117	23-45	34-53	18-26	1.43-1.66	4.2-14.1	0.08-0.18	0.4-2.1	0.2-1.6
	117-145	10-43	39-61	17-29	1.31-1.68	4.2-14.1	0.06-0.13	0.5-1.3	0.2-0.6
	145-200	10-43	39-61	17-29	1.31-1.68	4.2-14.1	0.06-0.13	0.5-1.3	0.1-0.5
LuC:									
Lithic Udorthents, leveled land---	0-10	20-70	10-79	0-35	---	---	0.04-0.10	---	0.0-0.5
	10-22	0-70	10-79	0-35	---	---	0.04-0.10	---	0.0-0.1
	22-32	---	---	---	---	0.0-10.0	---	---	---

Table 21.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	Cm	Pct	Pct	Pct	g/cc	um/sec	Cm/cm	Pct	Pct
LxG:									
Lithic Udorthents, cut land-----------	0-10	20-70	10-79	0-35	---	---	0.04-0.10	---	0.0-0.5
	10-22	0-70	10-79	0-35	---	---	0.04-0.10	---	0.0-0.1
	22-32	---	---	---	---	0.0-10.0	---	---	---
NaB:									
Nallen----------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-4	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	4-13	30-68	24-54	9-18	0.80-1.20	4.0-42.0	0.14-0.17	2.0-2.2	4.0-12
	13-23	28-64	28-54	8-21	1.20-1.30	14.0-42.0	0.09-0.17	0.2-1.1	1.5-6.5
	23-48	29-65	24-49	9-21	1.26-1.56	14.0-42.0	0.09-0.17	0.4-2.4	0.5-1.2
	48-86	31-70	19-35	5-18	1.40-1.70	14.0-42.0	0.06-0.16	0.4-1.1	0.2-0.3
	86-96	---	---	---	---	0.4-14.1	---	---	---
NaC:									
Nallen----------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-4	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	4-13	30-68	24-54	9-18	0.80-1.20	4.0-42.0	0.14-0.17	2.0-2.2	4.0-12
	13-23	28-64	28-54	8-21	1.20-1.30	14.0-42.0	0.09-0.17	0.2-1.1	1.5-6.5
	23-48	29-65	24-49	9-21	1.26-1.56	14.0-42.0	0.09-0.17	0.4-2.4	0.5-1.2
	48-86	31-70	19-35	5-18	1.40-1.70	14.0-42.0	0.06-0.16	0.4-1.1	0.2-0.3
	86-96	---	---	---	---	0.4-14.1	---	---	---
NaD:									
Nallen----------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-4	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	4-13	30-68	24-54	9-18	0.80-1.20	4.0-42.0	0.14-0.17	2.0-2.2	4.0-12
	13-23	28-64	28-54	8-21	1.20-1.30	14.0-42.0	0.09-0.17	0.2-1.1	1.5-6.5
	23-48	29-65	24-49	9-21	1.26-1.56	14.0-42.0	0.09-0.17	0.4-2.4	0.5-1.2
	48-86	31-70	19-35	5-18	1.40-1.70	14.0-42.0	0.06-0.16	0.4-1.1	0.2-0.3
	86-96	---	---	---	---	0.4-14.1	---	---	---

Table 21.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	Cm	Pct	Pct	Pct	g/cc	um/sec	Cm/cm	Pct	Pct
PsA:									
Pope, rarely flooded--------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-5	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	5-18	43-85	0-50	0-20	1.20-1.40	14.0-42.0	0.10-0.16	0.0-2.9	1.0-4.0
	18-81	23-85	0-50	0-27	1.30-1.60	4.0-42.0	0.10-0.18	0.0-2.9	0.3-2.0
	81-200	43-90	0-50	0-20	1.30-1.60	4.0-42.0	0.10-0.18	0.0-2.9	0.3-1.6
PvA:									
Pope, occasionally flooded--------	0-3	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	3-5	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	5-18	43-85	0-50	0-20	1.20-1.40	14.0-42.0	0.10-0.16	0.0-2.9	1.0-4.0
	18-81	23-85	0-50	0-27	1.30-1.60	4.0-42.0	0.10-0.18	0.0-2.9	0.3-2.0
	81-200	43-90	0-50	0-20	1.30-1.60	4.0-42.0	0.10-0.18	0.0-2.9	0.3-1.6
Craigsville, occasionally flooded--------	0-5	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	5-8	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	8-21	23-75	15-35	0-20	1.20-1.40	14.0-141.0	0.05-0.15	0.0-2.9	1.0-5.0
	21-60	30-75	15-35	0-20	1.30-1.60	14.0-141.0	0.05-0.15	0.0-2.9	0.3-2.0
	60-200	60-90	5-50	0-15	1.35-1.55	14.0-141.0	0.05-0.09	0.0-2.9	0.3-1.6
ThB:									
Typic Haplorthods, rarely flooded-	0-2	14-48	0	0-0	0.05-0.20	42.0-141.0	0.00-0.03	---	52-86
	2-4	16-52	0	0-0	0.10-0.20	42.0-141.0	0.03-0.08	---	48-84
	4-13	43-70	5-40	2-20	1.20-1.40	14.0-42.0	0.10-0.16	0.0-2.9	10-34
	13-33	60-90	2-15	2-12	1.40-1.60	42.3-141.1	0.06-0.10	0.0-2.9	0.0-0.5
	33-43	60-85	2-30	2-12	1.40-1.60	4.2-14.1	0.06-0.10	0.0-2.9	4.0-16
	43-92	60-85	2-40	2-10	1.40-1.60	42.3-141.1	0.04-0.10	0.0-2.9	1.0-6.0
	92-165	75-95	2-15	2-10	1.40-1.60	42.3-141.1	0.04-0.10	0.0-2.9	0.0-0.5
UgC:									
Udorthents, graded---------	0-4	---	---	0-35	---	---	---	---	0.0-0.5
	4-27	---	---	0-35	---	---	---	---	0.0-0.5
	27-165	---	---	0-35	---	---	---	---	0.0-0.1

Table 21.—Physical Soil Properties—Continued

Map unit symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Shrink-swell potential	Organic matter
	Cm	Pct	Pct	Pct	g/cc	um/sec	Cm/cm	Pct	Pct
UgF:									
Udorthents,									
graded---------	0-4	---	---	0-35	---	---	---	---	0.0-0.5
	4-27	---	---	0-35	---	---	---	---	0.0-0.5
	27-165	---	---	0-35	1.20-1.65	---	---	---	0.0-0.1
Uu:									
Udorthents,									
highways-------	0-4	0-70	10-79	0-35	---	---	---	---	0.0-0.5
	4-27	0-70	10-79	0-35	---	---	---	---	0.0-0.5
	27-165	0-70	10-79	0-35	---	---	---	---	0.0-0.1

Table 22.—Erosion Properties

(Entries under "Erosion factors" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer)

Map unit symbol and soil name	Depth (centimeters)	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
AgC:						
Allegheny	0-1	---	---	5	6	48
	1-4	---	---			
	4-26	.37	.37			
	26-42	.37	.37			
	42-165	.32	.32			
BhG:						
Berks	0-2	---	---	2	7	38
	2-19	.10	.28			
	19-28	.17	.37			
	28-76	.17	.43			
	76-98	.10	.49			
	98-108	---	---			
Highsplint	0-3	---	---	4	6	48
	3-18	.10	.24			
	18-27	.15	.32			
	27-108	.15	.43			
	108-135	.10	.43			
	135-165	.10	.37			
Sharondale	0-5	---	---	5	7	38
	5-38	.10	.20			
	38-51	.15	.28			
	51-160	.10	.32			
	160-218	.10	.37			
	218-228	---	---			
BuC:						
Buchanan	0-3	---	---	3	3	86
	3-20	.32	.32			
	20-53	.20	.43			
	53-152	.20	.43			
	152-165	.15	.32			
ClB:						
Clifftop	0-3	---	---	3	6	48
	3-8	.20	.32			
	8-20	.37	.37			
	20-74	.24	.37			
	74-91	.10	.37			
	91-101	---	---			
ClC:						
Clifftop	0-3	---	---	3	6	48
	3-8	.20	.32			
	8-20	.37	.37			
	20-74	.24	.37			
	74-91	.10	.37			
	91-101	---	---			
ClD:						
Clifftop	0-3	---	---	3	6	48
	3-8	.20	.32			
	8-20	.37	.37			
	20-74	.24	.37			
	74-91	.10	.37			
	91-101	---	---			

Table 22.—Erosion Properties—Continued

Map unit symbol and soil name	Depth (centimeters)	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
ClE:						
Clifftop	0-3	---	---	3	6	48
	3-8	.20	.32			
	8-20	.37	.37			
	20-74	.24	.37			
	74-91	.10	.37			
	91-99	---	---			
CmC:						
Clifftop	0-3	---	---	3	6	48
	3-8	.20	.32			
	8-20	.37	.37			
	20-74	.24	.37			
	74-91	.10	.37			
	91-101	---	---			
CwB:						
Cottonbend	0-1	---	---	5	5	56
	1-8	.43	.43			
	8-20	.43	.43			
	20-61	.43	.43			
	61-102	.37	.37			
	102-128	.37	.37			
	128-200	.37	.37			
CwC:						
Cottonbend	0-1	---	---	5	5	56
	1-8	.43	.43			
	8-20	.43	.43			
	20-61	.43	.43			
	61-102	.37	.37			
	102-128	.37	.37			
	128-200	.37	.37			
DkC:						
Dekalb	0-1	---	---	2	6	48
	1-3	---	---			
	3-8	.05	.20			
	8-20	.10	.24			
	20-65	.10	.32			
	65-80	.10	.37			
	80-90	---	---			
DrE:						
Dekalb	0-1	---	---	2	6	48
	1-3	---	---			
	3-8	.05	.20			
	8-20	.10	.24			
	20-65	.10	.32			
	65-80	.10	.37			
	80-90	---	---			
Rock outcrop.						
FeB:						
Fenwick	0-3	---	---	2	5	56
	3-8	.37	.37			
	8-23	.32	.32			
	23-66	.37	.37			
	66-86	.43	.43			
	86-99	.43	.43			
	99-109	---	---			

Table 22.—Erosion Properties—Continued

Map unit symbol and soil name	Depth (centimeters)	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
FeC:						
Fenwick	0-3	---	---	2	5	56
	3-8	.37	.37			
	8-23	.32	.32			
	23-66	.37	.37			
	66-86	.43	.43			
	86-99	.43	.43			
	99-109	---	---			
HgE:						
Highsplint	0-3	---	---	4	6	48
	3-18	.10	.24			
	18-27	.15	.32			
	27-108	.15	.43			
	108-135	.10	.43			
	135-165	.10	.37			
LaC:						
Laidig	0-2	---	---	4	6	48
	2-9	.15	.28			
	9-19	.20	.28			
	19-80	.24	.37			
	80-122	.24	.43			
	122-200	.20	.43			
LbC:						
Laidig	0-2	---	---	4	6	48
	2-9	.15	.28			
	9-19	.20	.28			
	19-80	.24	.37			
	80-122	.24	.43			
	122-200	.20	.43			
LcE:						
Laidig	0-2	---	---	4	6	48
	2-9	.15	.28			
	9-19	.20	.28			
	19-80	.24	.37			
	80-122	.24	.43			
	122-200	.20	.43			
Clifftop	0-3	---	---	3	6	48
	3-8	.20	.32			
	8-20	.37	.37			
	20-74	.24	.37			
	74-91	.10	.37			
	91-101	---	---			
LdF:						
Layland	0-3	---	---	4	6	48
	3-5	---	---			
	5-15	.15	.28			
	15-23	.20	.37			
	23-117	.15	.37			
	117-145	.10	.43			
	145-200	.10	.43			
Clifftop	0-3	---	---	3	6	48
	3-8	.20	.32			
	8-20	.37	.37			
	20-74	.24	.37			
	74-91	.10	.37			
	91-101	---	---			

Table 22.—Erosion Properties—Continued

Map unit symbol and soil name	Depth (centimeters)	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
LhE:						
Layland	0-3	---	---	4	6	48
	3-5	---	---			
	5-15	.15	.28			
	15-23	.20	.37			
	23-117	.15	.37			
	117-145	.10	.43			
	145-200	.10	.43			
Laidig	0-2	---	---	4	6	48
	2-9	.15	.28			
	9-19	.20	.28			
	19-80	.24	.37			
	80-122	.24	.43			
	122-200	.20	.43			
LkE:						
Layland	0-3	---	---	4	6	48
	3-5	---	---			
	5-15	.15	.28			
	15-23	.20	.37			
	23-117	.15	.37			
	117-145	.10	.43			
	145-200	.10	.43			
Laidig	0-2	---	---	4	6	48
	2-9	.15	.28			
	9-19	.20	.28			
	19-80	.24	.37			
	80-122	.24	.43			
	122-200	.20	.43			
LmF:						
Layland	0-3	---	---	4	6	48
	3-5	---	---			
	5-15	.15	.28			
	15-23	.20	.37			
	23-117	.15	.37			
	117-145	.10	.43			
	145-200	.10	.43			
Rock outcrop.						
LuC:						
Lithic Udorthents, leveled land	0-10	---	---	1	---	---
	10-22	---	---			
	22-32	---	---			
LxG:						
Lithic Udorthents, cut land	0-10	---	---	1	---	---
	10-22	---	---			
	22-32	---	---			
Rock outcrop.						
NaB:						
Nallen	0-3	---	---	2	5	56
	3-4	---	---			
	4-13	.24	.24			
	13-23	.32	.32			
	23-48	.37	.37			
	48-86	.24	.32			
	86-96	---	---			

Table 22.—Erosion Properties—Continued

Map unit symbol and soil name	Depth (centimeters)	Erosion factors Kw	Kf	T	Wind erodi- bility group	Wind erodi- bility index
NaC:						
Nallen	0-3	---	---	2	5	56
	3-4	---	---			
	4-13	.24	.24			
	13-23	.32	.32			
	23-48	.37	.37			
	48-86	.24	.32			
	86-96	---	---			
NaD:						
Nallen	0-3	---	---	2	5	56
	3-4	---	---			
	4-13	.24	.24			
	13-23	.32	.32			
	23-48	.37	.37			
	48-86	.24	.32			
	86-96	---	---			
PsA:						
Pope, rarely flooded	0-3	---	---	4	3	86
	3-5	---	---			
	5-18	.17	.17			
	18-81	.24	.24			
	81-200	.05	.15			
PvA:						
Pope, occasionally flooded	0-3	---	---	4	3	86
	3-5	---	---			
	5-18	.17	.17			
	18-81	.24	.24			
	81-200	.05	.15			
Craigsville, occasionally flooded	0-5	---	---	3	6	48
	5-8	---	---			
	8-21	.05	.17			
	21-60	.05	.24			
	60-200	.02	.05			
Rw.						
Riverwash, frequently flooded						
ThB:						
Typic Haplorthods, rarely flooded	0-2	---	---	2	3	86
	2-4	---	---			
	4-13	.17	.17			
	13-33	.15	.15			
	33-43	.24	.24			
	43-92	.05	.20			
	92-165	.02	.05			
UgC:						
Udorthents, graded	0-4	---	---	3	---	---
	4-27	---	---			
	27-165	---	---			
UgF:						
Udorthents, graded	0-4	---	---	3	---	---
	4-27	---	---			
	27-165	---	---			

Table 22.—Erosion Properties—Continued

Map unit symbol and soil name	Depth (centimeters)	Erosion factors Kw	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
Ur.						
Udorthents, railroad grade						
Uu:						
Udorthents, highways-----------	0-4	---	---	3	---	---
	4-27	---	---			
	27-165	---	---			
Urban land, highways.						
W.						
Water						
Wr.						
Water-Rubble land						

Table 23.—Total Soil Carbon

(This table displays soil organic carbon (SOC) and soil inorganic carbon (SIC) in kilograms per square meter to a depth of 2 meters or to the representative top depth of any kind of bedrock or any cemented soil horizon. SOC and SIC are reported on a volumetric whole soil basis, corrected for representative rock fragments indicated in the database. SOC is converted from horizon soil organic matter of the fraction of the soil less than 2 mm in diameter. If soil organic matter indicated in the database is NULL, SOC is assumed to be zero. SIC is converted from horizon calcium carbonate content fraction of the soil less than 2 mm in diameter. If horizon calcium carbonate indicated in the database is NULL, SIC is assumed to be zero. A weighted average of all horizons is used in the calculations. Only major components of a map unit are displayed in this table)

Map unit symbol, component name, and component percent	SOC	SIC
	kg/m^2	kg/m^2
AgC:		
Allegheny (80%)	10	0
BhG:		
Berks (35%)	11	0
Highsplint (30%)	11	0
Sharondale (20%)	29	0
BuC:		
Buchanan (80%)	6	0
ClB:		
Clifftop (80%)	8	0
ClC:		
Clifftop (80%)	8	0
ClD:		
Clifftop (75%)	8	0
ClE:		
Clifftop (70%)	9	0
CmC:		
Clifftop (75%)	8	0
CwB:		
Cottonbend (90%)	8	0
CwC:		
Cottonbend (90%)	8	0
DkC:		
Dekalb (80%)	10	0
DrE:		
Dekalb (55%)	9	0
Rock outcrop (15%)	0	0

Table 23.—Total Soil Carbon—Continued

Map unit symbol, component name, and component percent	SOC	SIC
	kg/m2	kg/m2
FeB:		
Fenwick (85%)	13	0
FeC:		
Fenwick (85%)	13	0
HgE:		
Highsplint (70%)	10	0
LaC:		
Laidig (70%)	11	0
LbC:		
Laidig (75%)	10	0
LcE:		
Laidig (45%)	11	0
Clifftop (25%)	9	0
LdF:		
Layland (60%)	12	0
Clifftop (20%)	8	0
LhE:		
Layland (60%)	13	0
Laidig (25%)	10	0
LkE:		
Layland (55%)	10	0
Laidig (30%)	9	0
LmF:		
Layland (60%)	10	0
Rock outcrop (10%)	0	0
LuC:		
Lithic Udorthents, leveled land (85%)	0	0
LxG:		
Lithic Udorthents, cut land (50%)	0	0
Rock outcrop (40%)	0	0
NaB:		
Nallen (80%)	10	0
NaC:		
Nallen (75%)	10	0
NaD:		
Nallen (75%)	10	0
PsA:		
Pope, rarely flooded (85%)	19	0

Table 23.—Total Soil Carbon—Continued

Map unit symbol, component name, and component percent	SOC	SIC
	kg/m^2	kg/m^2
PvA:		
Pope, occasionally flooded (50%)	19	0
Craigsville, occasionally flooded (30%)	18	0
Rw:		
Riverwash, frequently flooded (95%)	0	0
ThB:		
Typic Haplorthods, rarely flooded (80%)	27	0
UgC:		
Udorthents, graded (85%)	0	0
UgF:		
Udorthents, graded (85%)	0	0
Ur:		
Udorthents, railroad grade (93%)	0	0
Uu:		
Udorthents, highways (70%)	0	0
Urban land, highways (25%)	0	0
W:		
Water (100%)	0	0
Wr:		
Water (75%)	0	0
Rubble land, frequently flooded (25%)	0	0

Table 24.—Chemical Soil Properties

(Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction
	Cm	meq/100 g	meq/100 g	pH
AgC:				
Allegheny	0-1	---	5.0-60.0	3.8-5.2
	1-4	---	10.0-75.0	3.5-5.0
	4-26	10.0-20.0	3.8-8.4	3.6-5.5
	26-42	10.0-20.0	3.8-8.4	3.6-5.5
	42-165	10.0-15.0	3.6-7.4	3.6-5.5
BhG:				
Berks	0-2	40.0-125.0	5.0-60.0	5.1-6.3
	2-19	13.8-24.6	6.0-14.1	4.2-6.1
	19-28	6.2-12.9	2.8-6.1	4.4-5.3
	28-76	5.5-12.8	1.8-6.8	4.4-5.2
	76-98	6.0-16.0	3.4-12.3	4.6-5.4
	98-108	---	---	---
Highsplint	0-3	40.0-125.0	5.0-60.0	5.1-6.1
	3-18	10.4-19.0	4.0-15.1	4.5-6.0
	18-27	5.3-9.9	2.8-5.5	4.0-5.5
	27-108	4.9-9.7	2.5-6.3	3.5-5.5
	108-135	6.2-8.7	3.6-5.4	3.5-5.5
	135-165	5.6-8.6	3.9-6.0	3.5-5.5
Sharondale	0-5	40.0-125.0	5.0-60.0	5.3-6.3
	5-38	7.0-37.0	---	5.1-7.3
	38-51	6.4-20.0	---	5.1-7.3
	51-160	6.0-15.6	---	5.1-7.3
	160-218	6.2-14.6	---	5.1-7.3
	218-228	---	---	---
BuC:				
Buchanan	0-3	60.0-125.0	10.0-75.0	3.5-5.0
	3-20	4.8-13.5	3.6-10.1	3.6-5.5
	20-53	4.5-8.6	3.4-6.5	3.6-5.5
	53-152	4.5-8.6	3.4-6.5	3.6-5.5
	152-165	4.5-9.9	3.4-7.4	3.6-5.5
ClB:				
Clifftop	0-3	---	5.0-60.0	4.1-5.5
	3-8	8.0-53.0	5.0-19.0	3.5-5.5
	8-20	5.0-22.0	3.0-7.0	3.9-5.0
	20-74	5.0-15.0	3.0-11.0	4.2-5.2
	74-91	6.0-17.0	4.0-11.0	4.4-5.0
	91-101	---	---	---
ClC:				
Clifftop	0-3	---	5.0-60.0	4.1-5.5
	3-8	8.0-53.0	5.0-19.0	3.5-5.5
	8-20	5.0-22.0	3.0-7.0	3.9-5.0
	20-74	5.0-15.0	3.0-11.0	4.2-5.2
	74-91	6.0-17.0	4.0-11.0	4.4-5.0
	91-101	---	---	---
ClD:				
Clifftop	0-3	---	5.0-60.0	4.1-5.5
	3-8	8.0-53.0	5.0-19.0	3.5-5.5
	8-20	5.0-22.0	3.0-7.0	3.9-5.0
	20-74	5.0-15.0	3.0-11.0	4.2-5.2
	74-91	6.0-17.0	4.0-11.0	4.4-5.0
	91-101	---	---	---

Table 24.—Chemical Soil Properties—Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction
	Cm	meq/100 g	meq/100 g	pH
ClE:				
Clifftop	0-3	---	5.0-60.0	4.1-5.5
	3-8	8.0-53.0	5.0-19.0	3.5-5.5
	8-20	5.0-22.0	3.0-7.0	3.9-5.0
	20-74	5.0-15.0	3.0-11.0	4.2-5.2
	74-91	6.0-17.0	4.0-11.0	4.4-5.0
	91-99	---	---	---
CmC:				
Clifftop	0-3	---	5.0-60.0	4.1-5.5
	3-8	8.0-53.0	5.0-19.0	3.5-5.5
	8-20	5.0-22.0	3.0-7.0	3.9-5.0
	20-74	5.0-15.0	3.0-11.0	4.2-5.2
	74-91	6.0-17.0	4.0-11.0	4.4-5.0
	91-101	---	---	---
CwB:				
Cottonbend	0-1	---	5.0-60.0	3.8-5.2
	1-8	2.9-9.3	---	4.5-6.0
	8-20	2.9-9.9	---	4.5-6.0
	20-61	---	2.7-8.4	3.5-5.5
	61-102	---	3.5-8.4	3.5-5.5
	102-128	---	3.5-8.4	3.5-5.5
	128-200	---	2.9-12.3	3.5-5.5
CwC:				
Cottonbend	0-1	---	5.0-60.0	3.8-5.2
	1-8	2.9-9.3	---	4.5-6.0
	8-20	2.9-9.9	---	4.5-6.0
	20-61	---	2.7-8.4	3.5-5.5
	61-102	---	3.5-8.4	3.5-5.5
	102-128	---	3.5-8.4	3.5-5.5
	128-200	---	2.9-12.3	3.5-5.5
DkC:				
Dekalb	0-1	---	5.0-60.0	3.8-5.0
	1-3	---	10.0-75.0	3.5-4.5
	3-8	11.0-68.0	7.8-13.5	3.5-5.5
	8-20	6.8-12.8	4.5-6.0	3.6-5.4
	20-65	3.4-7.4	1.6-7.2	3.6-5.4
	65-80	3.4-7.3	1.8-6.0	3.6-5.4
	80-90	---	---	---
DrE:				
Dekalb	0-1	---	5.0-60.0	3.8-5.0
	1-3	---	10.0-75.0	3.5-4.5
	3-8	11.0-68.0	7.8-13.5	3.5-5.5
	8-20	6.8-12.8	4.5-6.0	3.6-5.4
	20-65	3.4-7.4	1.6-7.2	3.6-5.4
	65-80	3.4-7.3	1.8-6.0	3.6-5.4
	80-90	---	---	---
FeB:				
Fenwick	0-3	---	10.0-75.0	3.9-5.3
	3-8	---	1.5-4.7	3.5-5.0
	8-23	---	1.6-4.8	4.0-5.0
	23-66	---	3.6-7.3	4.0-5.0
	66-86	---	3.2-7.3	4.0-5.0
	86-99	---	2.9-6.5	4.0-5.0
	99-109	---	---	---

Table 24.—Chemical Soil Properties—Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction
	Cm	meq/100 g	meq/100 g	pH
FeC:				
Fenwick	0-3	---	10.0-75.0	3.9-5.3
	3-8	---	1.5-4.7	3.5-5.0
	8-23	---	1.6-4.8	4.0-5.0
	23-66	---	3.6-7.3	4.0-5.0
	66-86	---	3.2-7.3	4.0-5.0
	86-99	---	2.9-6.5	4.0-5.0
	99-109	---	---	---
HgE:				
Highsplint	0-3	40.0-125.0	5.0-60.0	5.1-6.1
	3-18	10.4-19.0	4.0-15.1	4.5-6.0
	18-27	5.3-9.9	2.8-5.5	4.0-5.5
	27-108	4.9-9.7	2.5-6.3	3.5-5.5
	108-135	6.2-8.7	3.6-5.4	3.5-5.5
	135-165	5.6-8.6	3.9-6.0	3.5-5.5
LaC:				
Laidig	0-2	---	5.0-60.0	3.8-5.2
	2-9	9.9-62.9	4.5-16.8	3.9-4.3
	9-19	6.1-21.3	3.3-8.2	3.9-4.6
	19-80	4.4-9.2	2.4-4.9	4.4-4.8
	80-122	4.7-10.2	2.9-5.4	4.6-4.9
	122-200	3.8-9.9	2.3-4.3	4.4-5.1
LbC:				
Laidig	0-2	---	5.0-60.0	3.8-5.2
	2-9	9.9-62.9	4.5-16.8	3.9-4.3
	9-19	6.1-21.3	3.3-8.2	3.9-4.6
	19-80	4.4-9.2	2.4-4.9	4.4-4.8
	80-122	4.7-10.2	2.9-5.4	4.6-4.9
	122-200	3.8-9.9	2.3-4.3	4.4-5.1
LcE:				
Laidig	0-2	---	5.0-60.0	3.8-5.2
	2-9	9.9-62.9	4.5-16.8	3.9-4.3
	9-19	6.1-21.3	3.3-8.2	3.9-4.6
	19-80	4.4-9.2	2.4-4.9	4.4-4.8
	80-122	4.7-10.2	2.9-5.4	4.6-4.9
	122-200	3.8-9.9	2.3-4.3	4.4-5.1
Clifftop	0-3	---	5.0-60.0	4.1-5.5
	3-8	8.0-53.0	5.0-19.0	3.5-5.5
	8-20	5.0-22.0	3.0-7.0	3.9-5.0
	20-74	5.0-15.0	3.0-11.0	4.2-5.2
	74-91	6.0-17.0	4.0-11.0	4.4-5.0
	91-101	---	---	---
LdF:				
Layland	0-3	---	5.0-60.0	3.8-5.2
	3-5	---	10.0-75.0	3.5-5.0
	5-15	0.0-29.4	5.4-16.3	3.5-5.0
	15-23	6.9-9.3	4.3-6.4	3.5-5.0
	23-117	4.3-7.4	3.3-5.6	3.5-5.0
	117-145	6.5-7.8	4.9-9.5	3.5-5.0
	145-200	6.5-7.8	4.9-9.5	3.5-5.0

Table 24.—Chemical Soil Properties—Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction
	Cm	meq/100 g	meq/100 g	pH
LdF:				
Clifftop	0-3	---	5.0-60.0	4.1-5.5
	3-8	8.0-53.0	5.0-19.0	3.5-5.5
	8-20	5.0-22.0	3.0-7.0	3.9-5.0
	20-74	5.0-15.0	3.0-11.0	4.2-5.2
	74-91	6.0-17.0	4.0-11.0	4.4-5.0
	91-101	---	---	---
LhE:				
Layland	0-3	---	5.0-60.0	3.8-5.2
	3-5	---	10.0-75.0	3.5-5.0
	5-15	0.0-29.4	5.4-16.3	3.5-5.0
	15-23	6.9-9.3	4.3-6.4	3.5-5.0
	23-117	4.3-7.4	3.3-5.6	3.5-5.0
	117-145	6.5-7.8	4.9-9.5	3.5-5.0
	145-200	6.5-7.8	4.9-9.5	3.5-5.0
Laidig	0-2	---	5.0-60.0	3.8-5.2
	2-9	9.9-62.9	4.5-16.8	3.9-4.3
	9-19	6.1-21.3	3.3-8.2	3.9-4.6
	19-80	4.4-9.2	2.4-4.9	4.4-4.8
	80-122	4.7-10.2	2.9-5.4	4.6-4.9
	122-200	3.8-9.9	2.3-4.3	4.4-5.1
LkE:				
Layland	0-3	---	5.0-60.0	3.8-5.2
	3-5	---	10.0-75.0	3.5-5.0
	5-15	0.0-29.4	5.4-16.3	3.5-5.0
	15-23	6.9-9.3	4.3-6.4	3.5-5.0
	23-117	4.3-7.4	3.3-5.6	3.5-5.0
	117-145	6.5-7.8	4.9-9.5	3.5-5.0
	145-200	6.5-7.8	4.9-9.5	3.5-5.0
Laidig	0-2	---	5.0-60.0	3.8-5.2
	2-9	9.9-62.9	4.5-16.8	3.9-4.3
	9-19	6.1-21.3	3.3-8.2	3.9-4.6
	19-80	4.4-9.2	2.4-4.9	4.4-4.8
	80-122	4.7-10.2	2.9-5.4	4.6-4.9
	122-200	3.8-9.9	2.3-4.3	4.4-5.1
LmF:				
Layland	0-3	---	5.0-60.0	3.8-5.2
	3-5	---	10.0-75.0	3.5-5.0
	5-15	0.0-29.4	5.4-16.3	3.5-5.0
	15-23	6.9-9.3	4.3-6.4	3.5-5.0
	23-117	4.3-7.4	3.3-5.6	3.5-5.0
	117-145	6.5-7.8	4.9-9.5	3.5-5.0
	145-200	6.5-7.8	4.9-9.5	3.5-5.0
LuC:				
Lithic Udorthents, leveled land	0-10	---	---	3.6-7.5
	10-22	---	---	3.6-7.5
	22-32	---	---	---
LxG:				
Lithic Udorthents, cut land	0-10	---	---	3.6-7.5
	10-22	---	---	3.6-7.5
	22-32	---	---	---

Table 24.—Chemical Soil Properties—Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction
	Cm	meq/100 g	meq/100 g	pH
NaB:				
Nallen	0-3	---	5.0-60.0	3.8-5.0
	3-4	---	10.0-75.0	3.5-4.8
	4-13	6.0-17.0	3.5-11.0	3.5-5.0
	13-23	3.0-7.0	3.0-6.0	3.5-5.0
	23-48	3.0-6.0	2.3-4.7	3.5-5.0
	48-86	4.0-5.0	3.0-4.5	3.5-5.0
	86-96	---	---	---
NaC:				
Nallen	0-3	---	5.0-60.0	3.8-5.0
	3-4	---	10.0-75.0	3.5-4.8
	4-13	6.0-17.0	3.5-11.0	3.5-5.0
	13-23	3.0-7.0	3.0-6.0	3.5-5.0
	23-48	3.0-6.0	2.3-4.7	3.5-5.0
	48-86	4.0-5.0	3.0-4.5	3.5-5.0
	86-96	---	---	---
NaD:				
Nallen	0-3	---	5.0-60.0	3.8-5.0
	3-4	---	10.0-75.0	3.5-4.8
	4-13	6.0-17.0	3.5-11.0	3.5-5.0
	13-23	3.0-7.0	3.0-6.0	3.5-5.0
	23-48	3.0-6.0	2.3-4.7	3.5-5.0
	48-86	4.0-5.0	3.0-4.5	3.5-5.0
	86-96	---	---	---
PsA:				
Pope, rarely flooded	0-3	---	5.0-60.0	3.8-5.2
	3-5	---	10.0-75.0	3.5-5.0
	5-18	4.0-14.2	3.0-10.7	3.6-5.5
	18-81	2.4-10.8	1.8-8.1	3.6-5.5
	81-200	2.4-10.6	1.8-8.0	3.6-5.5
PvA:				
Pope, occasionally flooded	0-3	---	5.0-60.0	3.8-5.2
	3-5	---	10.0-75.0	3.5-5.0
	5-18	4.0-14.2	3.0-10.7	3.6-5.5
	18-81	2.4-10.8	1.8-8.1	3.6-5.5
	81-200	2.4-10.6	1.8-8.0	3.6-5.5
Craigsville, occasionally flooded	0-5	---	5.0-60.0	3.8-5.2
	5-8	---	10.0-75.0	3.5-5.0
	8-21	4.0-16.5	3.0-12.4	4.5-5.5
	21-60	2.4-9.8	1.8-7.3	4.5-5.5
	60-200	0.7-7.1	0.5-5.3	4.5-5.5
ThB:				
Typic Haplorthods, rarely flooded	0-2	---	5.0-60.0	3.8-5.2
	2-4	---	10.0-75.0	3.5-5.0
	4-13	---	4.8-31.1	3.5-4.5
	13-33	---	0.1-4.5	3.5-4.5
	33-43	---	0.3-2.8	3.5-4.5
	43-92	---	0.3-2.7	3.5-5.0
	92-165	---	0.5-4.3	3.5-5.0

Table 24.—Chemical Soil Properties—Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction
	Cm	meq/100 g	meq/100 g	pH
UgC:				
Udorthents, graded---	0-4	---	---	3.6-7.5
	4-27	---	---	3.6-7.5
	27-165	---	---	3.6-7.5
UgF:				
Udorthents, graded---	0-4	---	---	3.6-7.5
	4-27	---	---	3.6-7.5
	27-165	---	---	3.6-7.5
Uu:				
Udorthents, highways-	0-4	---	---	3.6-7.5
	4-27	---	---	3.6-7.5
	27-165	---	0.0-3.5	3.6-7.5

Table 25.—Water Features

(See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map unit symbol and soil name	Hydrologic group	Months	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Cm	Cm	Cm				
AgC:									
Allegheny	B								
		---	---	---	---	---	---	---	---
BhG:									
Berks	B								
		---	---	---	---	---	---	---	---
Highsplint	B								
		---	---	---	---	---	---	---	---
Sharondale	A								
		---	---	---	---	---	---	---	---
BuC:									
Buchanan	C								
		January	61	84	---	---	None	---	None
		February	61	84	---	---	None	---	None
		March	61	84	---	---	None	---	None
		April	61	84	---	---	None	---	None
		May	61	84	---	---	None	---	None
		November	61	84	---	---	None	---	None
		December	61	84	---	---	None	---	None
ClB:									
Clifftop	C								
		---	---	---	---	---	---	---	---
ClC:									
Clifftop	C								
		---	---	---	---	---	---	---	---
ClD:									
Clifftop	C								
		---	---	---	---	---	---	---	---
ClE:									
Clifftop	C								
		---	---	---	---	---	---	---	---

Table 25.—Water Features—Continued

Map unit symbol and soil name	Hydrologic group	Months	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Cm	Cm	Cm				
CmC:									
Clifftop	C	---	---	---	---	---	---	---	---
CwB:									
Cottonbend	B	---	---	---	---	---	---	---	---
CwC:									
Cottonbend	B	---	---	---	---	---	---	---	---
DkC:									
Dekalb	A	---	---	---	---	---	---	---	---
DrE:									
Dekalb	A	---	---	---	---	---	---	---	---
Rock outcrop.									
FeB:									
Fenwick	C								
		January	48	99	---	---	None	---	None
		February	48	99	---	---	None	---	None
		March	48	99	---	---	None	---	None
		April	48	99	---	---	None	---	None
		November	48	99	---	---	None	---	None
		December	48	99	---	---	None	---	None
FeC:									
Fenwick	C								
		January	48	99	---	---	None	---	None
		February	48	99	---	---	None	---	None
		March	48	99	---	---	None	---	None
		April	48	99	---	---	None	---	None
		November	48	99	---	---	None	---	None
		December	48	99	---	---	None	---	None
HgE:									
Highsplint	B	---	---	---	---	---	---	---	---

Table 25.—Water Features—Continued

Map unit symbol and soil name	Hydrologic group	Months	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Cm	Cm	Cm				
LaC:									
Laidig	C								
		January	80	122	---	---	None	---	None
		February	80	122	---	---	None	---	None
		March	80	122	---	---	None	---	None
LbC:									
Laidig	B								
		January	80	122	---	---	None	---	None
		February	80	122	---	---	None	---	None
		March	80	122	---	---	None	---	None
LcE:									
Laidig	C								
		January	80	122	---	---	None	---	None
		February	80	122	---	---	None	---	None
		March	80	122	---	---	None	---	None
Clifftop	C								
		---	---	---	---	---	---	---	---
LdF:									
Layland	B								
		---	---	---	---	---	---	---	---
Clifftop	C								
		---	---	---	---	---	---	---	---
LhE:									
Layland	B								
		---	---	---	---	---	---	---	---
Laidig	C								
		January	80	122	---	---	None	---	None
		February	80	122	---	---	None	---	None
		March	80	122	---	---	None	---	None
LkE:									
Layland	A								
		---	---	---	---	---	---	---	---
Laidig	B								
		January	80	122	---	---	None	---	None
		February	80	122	---	---	None	---	None
		March	80	122	---	---	None	---	None

Table 25.—Water Features—Continued

Map unit symbol and soil name	Hydrologic group	Months	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Cm	Cm	Cm				
LmF:									
Layland	A	---	---	---	---	---	---	---	---
Rock outcrop.									
LuC:									
Lithic Udorthents, leveled land	D	---	---	---	---	---	---	---	---
LxG:									
Lithic Udorthents, cut land	D	---	---	---	---	---	---	---	---
Rock outcrop.									
NaB:									
Nallen	B	---	---	---	---	---	---	---	---
NaC:									
Nallen	B	---	---	---	---	---	---	---	---
NaD:									
Nallen	B	---	---	---	---	---	---	---	---
PsA:									
Pope, rarely flooded	A								
		January	---	---	---	---	None	Very brief	Rare
		February	---	---	---	---	None	Very brief	Rare
		March	---	---	---	---	None	Very brief	Rare
		April	---	---	---	---	None	Very brief	Rare
		May	---	---	---	---	None	Very brief	Rare
		November	---	---	---	---	None	Very brief	Rare
		December	---	---	---	---	None	Very brief	Rare
PvA:									
Pope, occasionally flooded	A								
		January	---	---	---	---	None	Very brief	Occasional
		February	---	---	---	---	None	Very brief	Occasional
		March	---	---	---	---	None	Very brief	Occasional
		April	---	---	---	---	None	Very brief	Occasional
		May	---	---	---	---	None	Very brief	Occasional
		November	---	---	---	---	None	Very brief	Occasional
		December	---	---	---	---	None	Very brief	Occasional

Table 25.—Water Features—Continued

Map unit symbol and soil name	Hydro-logic group	Months	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Cm	Cm	Cm				
PvA:									
Craigsville, occasionally flooded	A								
		January	137	>200	---	---	None	Very brief	Occasional
		February	137	>200	---	---	None	Very brief	Occasional
		March	137	>200	---	---	None	Very brief	Occasional
		April	137	>200	---	---	None	Very brief	Occasional
		May	137	>200	---	---	None	Very brief	Occasional
		November	137	>200	---	---	None	Very brief	Occasional
		December	137	>200	---	---	None	Very brief	Occasional
Rw:									
Riverwash, frequently flooded	---								
		January	---	---	---	---	None	Long	Frequent
		February	---	---	---	---	None	Long	Frequent
		March	---	---	---	---	None	Long	Frequent
		April	---	---	---	---	None	Long	Frequent
		May	---	---	---	---	None	Long	Frequent
		November	---	---	---	---	None	Long	Frequent
		December	---	---	---	---	None	Long	Frequent
ThB:									
Typic Haplorthods, rarely flooded	B								
		January	---	---	---	---	None	Very brief	Rare
		February	---	---	---	---	None	Very brief	Rare
		March	---	---	---	---	None	Very brief	Rare
		April	---	---	---	---	None	Very brief	Rare
		May	---	---	---	---	None	Very brief	Rare
		November	---	---	---	---	None	Very brief	Rare
		December	---	---	---	---	None	Very brief	Rare
UgC.									
Udorthents, graded									
UgF.									
Udorthents, graded									
Ur.									
Udorthents, railroad grade									
Uu.									
Udorthents-Urban land, highways									
W.									
Water									

Table 25.—Water Features—Continued

Map unit symbol and soil name	Hydro-logic group	Months	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Cm	Cm	Cm				
Wr:									
Water.									
Rubble land, frequently flooded	---								
		January	---	---	---	---	None	Brief	Frequent
		February	---	---	---	---	None	Brief	Frequent
		March	---	---	---	---	None	Brief	Frequent
		April	---	---	---	---	None	Brief	Frequent
		May	---	---	---	---	None	Brief	Frequent
		November	---	---	---	---	None	Brief	Frequent
		December	---	---	---	---	None	Brief	Frequent

Table 26.—Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that data were not estimated)

Map unit symbol and soil name	Restrictive layer: Kind	Restrictive layer: Depth to top	Restrictive layer: Thickness	Restrictive layer: Hardness	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
		Cm	Cm				
AgC:							
Allegheny	No restriction	---	---	---	Moderate	Moderate	High
Cotaco	No restriction	---	---	---	Moderate	High	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Knowlton, occasionally ponded	No restriction	---	---	---	High	High	High
BhG:							
Berks	Lithic bedrock	51-102	---	Strongly cemented	Moderate	Moderate	High
Highsplint	No restriction	---	---	---	Moderate	Moderate	High
Sharondale	Paralithic bedrock	152-251	---	Moderately cemented	Moderate	Low	Moderate
Matewan	Lithic bedrock	51-102	---	Strongly cemented	Moderate	Moderate	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Rock outcrop	Lithic bedrock	0-0	---	Indurated	---	---	---
BuC:							
Buchanan	Fragipan	53-53	---	Noncemented	Moderate	High	High
Laidig	Fragipan	76-127	41-132	Noncemented	Moderate	High	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Morehead	No restriction	---	---	---	High	High	Moderate
ClB:							
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Nallen	Lithic bedrock	51-102	---	Indurated	Moderate	Moderate	High
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High

Table 26.—Soil Features—Continued

Map unit symbol and soil name	Restrictive layer: Kind	Restrictive layer: Depth to top (Cm)	Restrictive layer: Thickness (Cm)	Restrictive layer: Hardness	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
ClB:							
Cookport	Fragipan	41-76	---	Noncemented	Moderate	High	High
	Lithic bedrock	102-183		Strongly cemented			
Fenwick	Lithic bedrock	51-109	---	Strongly cemented	Moderate	High	High
ClC:							
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Nallen	Lithic bedrock	51-102	---	Indurated	Moderate	Moderate	High
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High
Fenwick	Lithic bedrock	51-109	---	Strongly cemented	Moderate	High	High
Cookport	Fragipan	41-76	---	Noncemented	Moderate	High	High
	Lithic bedrock	102-183		Strongly cemented			
ClD:							
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Nallen	Lithic bedrock	51-102	---	Indurated	Moderate	Moderate	High
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High
Laidig	Fragipan	76-127	41-132	Noncemented	Moderate	High	High
Layland	No restriction	---	---	---	Moderate	High	High
ClE:							
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Nallen	Lithic bedrock	51-102	---	Indurated	Moderate	Moderate	High
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High
Layland	No restriction	---	---	---	Moderate	High	High
CmC:							
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High

Table 26.—Soil Features—Continued

Map unit symbol and soil name	Restrictive layer: Kind	Restrictive layer: Depth to top	Restrictive layer: Thickness	Restrictive layer: Hardness	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
		Cm	Cm				
CmC:							
Cookport	Fragipan	41-76	---	Noncemented	Moderate	High	High
	Lithic bedrock	102-183		Strongly cemented			
Fenwick	Lithic bedrock	51-109	---	Strongly cemented	Moderate	High	High
Nallen	Lithic bedrock	51-102	---	Indurated	Moderate	Moderate	High
CwB:							
Cottonbend	No restriction	---	---	---	Moderate	High	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Cotaco	No restriction	---	---	---	Moderate	High	High
CwC:							
Cottonbend	No restriction	---	---	---	Moderate	High	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Cotaco	No restriction	---	---	---	Moderate	High	High
DkC:							
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High
Fenwick	Lithic bedrock	51-109	---	Strongly cemented	Moderate	High	High
Nallen	Lithic bedrock	51-102	---	Indurated	Moderate	Moderate	High
DrE:							
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High
Rock outcrop	Lithic bedrock	0-0	---	Indurated	---	---	---
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Nallen	Lithic bedrock	51-102	---	Indurated	Moderate	Moderate	High
Layland	No restriction	---	---	---	Moderate	High	High
Totz	Lithic bedrock	25-51	---	Indurated	Low	Low	High

Table 26.—Soil Features—Continued

Map unit symbol and soil name	Restrictive layer: Kind	Restrictive layer: Depth to top	Restrictive layer: Thickness	Restrictive layer: Hardness	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
		Cm	Cm				
FeB:							
Fenwick	Lithic bedrock	51-109	---	Strongly cemented	Moderate	High	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High
Laidig	Fragipan	76-127	41-132	Noncemented	Moderate	High	High
FeC:							
Fenwick	Lithic bedrock	51-109	---	Strongly cemented	Moderate	High	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High
Laidig	Fragipan	76-127	41-132	Noncemented	Moderate	High	High
HgE:							
Highsplint	No restriction	---	---	---	Moderate	Moderate	High
Laidig	Fragipan	76-127	41-132	Noncemented	Moderate	High	High
Pineville	No restriction	---	---	---	Moderate	Moderate	High
Berks	Lithic bedrock	51-102	---	Strongly cemented	Moderate	Moderate	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Cotaco	No restriction	---	---	---	Moderate	High	High
LaC:							
Laidig	Fragipan	76-127	41-132	Noncemented	Moderate	High	High
Layland	No restriction	---	---	---	Moderate	High	High
Atkins, occasionally flooded	No restriction	---	---	---	High	High	Moderate
Philo, occasionally flooded	No restriction	---	---	---	Moderate	High	Moderate
Pope, occasionally flooded	No restriction	---	---	---	Moderate	Moderate	High
Rock outcrop	Lithic bedrock	0-0	---	Indurated	---	---	---

Table 26.—Soil Features—Continued

Map unit symbol and soil name	Restrictive layer				Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated steel	Concrete
		Cm	Cm				
LbC:							
Laidig	Fragipan	76-127	41-132	Noncemented	Moderate	High	High
Layland	No restriction	---	---	---	Moderate	High	High
Philo, occassionally flooded	No restriction	---	---	---	Moderate	High	Moderate
Pope, occasionally flooded	No restriction	---	---	---	Moderate	Moderate	High
Rock outcrop	Lithic bedrock	0-0	---	Indurated	---	---	---
LcE:							
Laidig	Fragipan	76-127	41-132	Noncemented	Moderate	High	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Layland	No restriction	---	---	---	Moderate	High	High
Nallen	Lithic bedrock	51-102	---	Indurated	Moderate	Moderate	High
Buchanan	Fragipan	53-53	---	Noncemented	Moderate	High	High
LdF:							
Layland	No restriction	---	---	---	Moderate	High	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Nallen	Lithic bedrock	51-102	---	Indurated	Moderate	Moderate	High
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High
Laidig	Fragipan	76-127	41-132	Noncemented	Moderate	High	High
LhE:							
Layland	No restriction	---	---	---	Moderate	High	High
Laidig	Fragipan	76-127	41-132	Noncemented	Moderate	High	High
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High
Philo, occasionally flooded	No restriction	---	---	---	Moderate	High	Moderate
Rock outcrop	Lithic bedrock	0-0	---	Indurated	---	---	---

Table 26.—Soil Features—Continued

Map unit symbol and soil name	Restrictive layer: Kind	Restrictive layer: Depth to top (Cm)	Restrictive layer: Thickness (Cm)	Restrictive layer: Hardness	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
LkE:							
Layland	No restriction	---	---	---	Moderate	High	High
Laidig	Fragipan	76-127	41-132	Noncemented	Moderate	High	High
Buchanan	Fragipan	53-53	---	Noncemented	Moderate	High	High
Craigsville, occasionally flooded	No restriction	---	---	---	Moderate	Moderate	High
Pope, occasionally flooded	No restriction	---	---	---	Moderate	Moderate	High
Riverwash, frequently flooded	No restriction	---	---	---	---	---	---
Rock outcrop	Lithic bedrock	0-0	---	Indurated	---	---	---
LmF:							
Layland	No restriction	---	---	---	Moderate	High	High
Rock outcrop	Lithic bedrock	0-0	---	Indurated	---	---	---
Laidig	Fragipan	76-127	41-132	Noncemented	Moderate	High	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High
Guyandotte	No restriction	---	---	---	Moderate	Moderate	Moderate
Rubble land	No restriction	---	---	---	---	---	---
Totz	Lithic bedrock	25-51	---	Indurated	Low	Low	High
LuC:							
Lithic Udorthents, leveled land	Lithic bedrock	10-50	---	Indurated	---	---	---
Udorthents, graded	No restriction	---	---	---	---	---	---
Rock outcrop	Lithic bedrock	0-0	---	Indurated	---	---	---
LxG:							
Lithic Udorthents, cut land	Lithic bedrock	10-50	---	Indurated	---	---	---
Rock outcrop	Lithic bedrock	0-0	---	Indurated	---	---	---
Udorthents, graded	No restriction	---	---	---	---	---	---

Table 26.—Soil Features—Continued

Map unit symbol and soil name	Restrictive layer				Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated steel	Concrete
		Cm	Cm				
NaB:							
Nallen	Lithic bedrock	51-102	---	Indurated	Moderate	Moderate	High
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Fenwick	Lithic bedrock	51-109	---	Strongly cemented	Moderate	High	High
NaC:							
Nallen	Lithic bedrock	51-102	---	Indurated	Moderate	Moderate	High
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Cookport	Fragipan	41-76	---	Noncemented	Moderate	High	High
	Lithic bedrock	102-183		Strongly cemented			
Fenwick	Lithic bedrock	51-109	---	Strongly cemented	Moderate	High	High
NaD:							
Nallen	Lithic bedrock	51-102	---	Indurated	Moderate	Moderate	High
Clymer	Lithic bedrock	122-132	---	Strongly cemented	Moderate	Moderate	High
Clifftop	Paralithic bedrock	51-102	---	Moderately cemented	Moderate	Moderate	High
Dekalb	Lithic bedrock	51-102	---	Indurated	Moderate	High	High
Fenwick	Lithic bedrock	51-109	---	Strongly cemented	Moderate	High	High
PsA:							
Pope, rarely flooded	No restriction	---	---	---	Moderate	Moderate	High
Atkins, occasionally flooded	No restriction	---	---	---	High	High	Moderate
Philo, rarely flooded	No restriction	---	---	---	Moderate	High	Moderate
Riverwash, frequently flooded	No restriction	---	---	---	---	---	---

Table 26.—Soil Features—Continued

Map unit symbol and soil name	Restrictive layer: Kind	Restrictive layer: Depth to top	Restrictive layer: Thickness	Restrictive layer: Hardness	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
		Cm	Cm				
PvA:							
Pope, occasionally flooded	No restriction	---	---	---	Moderate	Moderate	High
Craigsville, occasionally flooded	No restriction	---	---	---	Moderate	Moderate	High
Philo, occasionally flooded	No restriction	---	---	---	Moderate	High	Moderate
Riverwash, frequently flooded	No restriction	---	---	---	---	---	---
Atkins, occasionally flooded	No restriction	---	---	---	High	High	Moderate
Rw:							
Riverwash, frequently flooded	No restriction	---	---	---	---	---	---
Rubble land, frequently flooded	No restriction	---	---	---	---	---	---
ThB:							
Typic Haplorthods, rarely flooded	No restriction	---	---	---	Low	High	High
Craigsville, occasionally flooded	No restriction	---	---	---	Low	Moderate	High
Pope, occasionally flooded	No restriction	---	---	---	Low	Moderate	High
Riverwash, frequently flooded	No restriction	---	---	---	---	---	---
UgC:							
Udorthents, graded	No restriction	---	---	---	---	---	---
Lithic Udorthents, leveled land	Lithic bedrock	10-50	---	Indurated	---	---	---
Rock outcrop	Lithic bedrock	0-0	---	Indurated	---	---	---
Urban land	No restriction	---	---	---	---	---	---
UgF:							
Udorthents, graded	No restriction	---	---	---	---	---	---
Lithic Udorthents, cut land	Lithic bedrock	10-50	---	Indurated	---	---	---
Rock outcrop	Lithic bedrock	0-0	---	Indurated	---	---	---
Ur:							
Udorthents, railroad grade	No restriction	---	---	---	---	---	---
Rock outcrop	Lithic bedrock	0-0	---	Indurated	---	---	---

Table 26.—Soil Features—Continued

Map unit symbol and soil name	Restrictive layer: Kind	Restrictive layer: Depth to top (Cm)	Restrictive layer: Thickness (Cm)	Restrictive layer: Hardness	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
Ur:							
Urban land	No restriction	---	---	---	---	---	---
Endoaquepts, frequently ponded	No restriction	---	---	---	High	High	High
Uu:							
Udorthents, highways	No restriction	---	---	---	---	---	---
Urban land, highways	No restriction	---	---	---	---	---	---
Rock outcrop	Lithic bedrock	0-0	---	Indurated	---	---	---
W:							
Water	No restriction	---	---	---	---	---	---
Wr:							
Water	No restriction	---	---	---	---	---	---
Rubble land, frequently flooded	No restriction	---	---	---	---	---	---

Table 27.—Taxonomic Classification of the Soils

(An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series)

Soil name	Family or higher taxonomic class
Allegheny	Fine-loamy, mixed, semiactive, mesic Typic Hapludults
Berks	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
Buchanan	Fine-loamy, mixed, semiactive, mesic Aquic Fragiudults
Clifftop	Fine-loamy, mixed, semiactive, mesic Typic Hapludults
Cottonbend	Fine-loamy, siliceous, semiactive, mesic Typic Paleudults
Craigsville	Loamy-skeletal, mixed, superactive, mesic Fluventic Dystrudepts
*Dekalb	Loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts
Fenwick	Fine-loamy, mixed, semiactive, mesic Aquic Hapludults
Highsplint	Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
*Laidig	Fine-loamy, siliceous, semiactive, mesic Typic Fragiudults
Layland	Loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts
Lithic Udorthents	Lithic Udorthents
Nallen	Coarse-loamy, siliceous, semiactive, mesic Typic Hapludults
Pope	Coarse-loamy, mixed, active, mesic Fluventic Dystrudepts
Sharondale	Loamy-skeletal, mixed, active, mesic Typic Hapludolls
Typic Haplorthods	Loamy-skeletal, siliceous, active, mesic Typic Haplorthods
Udorthents	Udorthents

Table 28.—Soil Classification Key

(An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series)

```
ORDER
   Suborder
      Great Group
         Subgroup
            Series or Higher Category

ENTISOLS
   Orthents
      Udorthents

            Udorthents--------------------Udorthents
         Lithic Udorthents
            Lithic Udorthents-------------Lithic Udorthents
   Psamments
      Quartzipsamments
         Lithic Quartzipsamments
            Totz--------------------------Mesic, coated Lithic Quartzipsamments

INCEPTISOLS
   Aquepts
      Endoaquepts
            Endoaquepts-------------------Endoaquepts
         Fluvaquentic Endoaquepts
            Atkins------------------------Fine-loamy, mixed, active, acid, mesic Fluvaquentic
                                          Endoaquepts
   Udepts
      Dystrudepts
         Fluvaquentic Dystrudepts
            Philo-------------------------Coarse-loamy, mixed, active, mesic Fluvaquentic Dystrudepts
         Fluventic Dystrudepts
            Pope--------------------------Coarse-loamy, mixed, active, mesic Fluventic Dystrudepts
            Craigsville-------------------Loamy-skeletal, mixed, superactive, mesic Fluventic
                                          Dystrudepts
         Typic Dystrudepts
            Berks-------------------------Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
            Highsplint--------------------Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
            Matewan-----------------------Loamy-skeletal, mixed, active, mesic Typic Dystrudepts
           *Dekalb------------------------Loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts
            Layland-----------------------Loamy-skeletal, siliceous, semiactive, mesic Typic Dystrudepts
      Humudepts
         Typic Humudepts
            Guyandotte--------------------Loamy-skeletal, mixed, active, mesic Typic Humudepts

MOLLISOLS
   Udolls
      Hapludolls
         Typic Hapludolls
            Sharondale--------------------Loamy-skeletal, mixed, active, mesic Typic Hapludolls

SPODOSOLS
   Orthods
      Haplorthods
         Typic Haplorthods
            Typic Haplorthods-------------Loamy-skeletal, siliceous, active, mesic Typic Haplorthods
```

Table 28.—Soil Classification Key—Continued

ORDER / Suborder / Great Group / Subgroup / Series or Higher Category	
ULTISOLS	
Aquults	
Endoaquults	
Typic Endoaquults	
*Knowlton	Fine-loamy, mixed, semiactive, mesic Typic Endoaquults
Udults	
Fragiudults	
Typic Fragiudults	
*Laidig	Fine-loamy, siliceous, semiactive, mesic Typic Fragiudults
Aquic Fragiudults	
Buchanan	Fine-loamy, mixed, semiactive, mesic Aquic Fragiudults
*Cookport	Fine-loamy, mixed, semiactive, mesic Aquic Fragiudults
Hapludults	
Typic Hapludults	
Nallen	Coarse-loamy, siliceous, semiactive, mesic Typic Hapludults
*Clymer	Fine-loamy, mixed, active, mesic Typic Hapludults
Pineville	Fine-loamy, mixed, active, mesic Typic Hapludults
Allegheny	Fine-loamy, mixed, semiactive, mesic Typic Hapludults
Clifftop	Fine-loamy, mixed, semiactive, mesic Typic Hapludults
Aquic Hapludults	
Cotaco	Fine-loamy, mixed, semiactive, mesic Aquic Hapludults
Fenwick	Fine-loamy, mixed, semiactive, mesic Aquic Hapludults
Morehead	Fine-silty, mixed, semiactive, mesic Aquic Hapludults
Paleudults	
Typic Paleudults	
Cottonbend	Fine-loamy, siliceous, semiactive, mesic Typic Paleudults

Appendices

Appendix 1.—West Virginia Grassland Suitability Groups

Click here for document.

Appendix 2.—Vegetation Classification and Mapping of Gauley River National Recreation Area, West Virginia

Click here for document.

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West Virginia

Grassland Suitability Groups

Statewide Counties

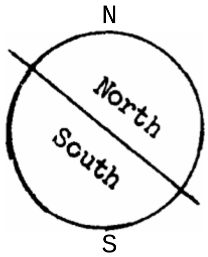
Natural Resources Conservation Service

GRASSLAND SUITABILITY GROUPS (GSG)

Definition - A GSG is a grouping of soils with similar capabilities for growing adapted herbaceous species and which will show a similar response to management, i.e., it is the "soil capability unit" for Grassland.

Soil mapping units were grouped according to their common soil property criteria (see GSG grouping key in the Appendix) into the following primary groups: Acid Hills, Acid Loams, Dry Hills, Droughty Shales, Dry Uplands, Fertile Hills, Fertile Loams, Limy Hills, Limy Uplands, Moist Hills, Moist Loams, Not Suited, Very Rocky Acid Soils, Very Rocky Limy Soils, Sands, Shale Hills, and Wetlands.

Where aspect can be identified on slopes over 8%, groupings can be further divided into "North" (N) or "South" (S) during the field resource inventory visit. Designation of (N) or (S) should be made on the basis of the following diagram:



Soil mapping units occurring in each GSG are listed in this section. Reclassification of the listings will occur as adequate data is obtained from soil-site correlation and field experience. New primary or secondary groupings may be added as practical or desirable in the future according to field experience and needs.

This section includes:

- Definition of Climate Precipitation Zones.
- Brief Grassland Suitability Group descriptions.
- Detailed GSG descriptions.
- Alphabetical listing of all soil mapping units and their respective GSG grouping.

GSG’s for individual counties may be found on the Soil Data Mart.

CLIMATE

30-40" Precipitation Zone*

Normal precipitation ranges from 35" to 38" in most of the zone, primarily in the form of rain. Isolated areas may receive as little as 28", such as near Rig in Hardy County and Upper Tract in Pendleton County. Growing season rainfall is approximately l8", with October being the driest month. Thunderstorm rainfall may be highly erratic in location and amount, especially during July and August. Stress periods of low rainfall during the growing season are common. Season long droughts can be expected about once every ten years. Mean annual snowfall varies from 20 to 40 inches. Snow cover, one inch or more, occurs 30-45 days per year. Approximate mean maximum and minimum July temperatures are 86 and 60 degrees. Temperature extremes of 112°F to -25°F have been recorded. Elevations range from 240 to 4,860 feet. Average frost free period is 150-175 days.

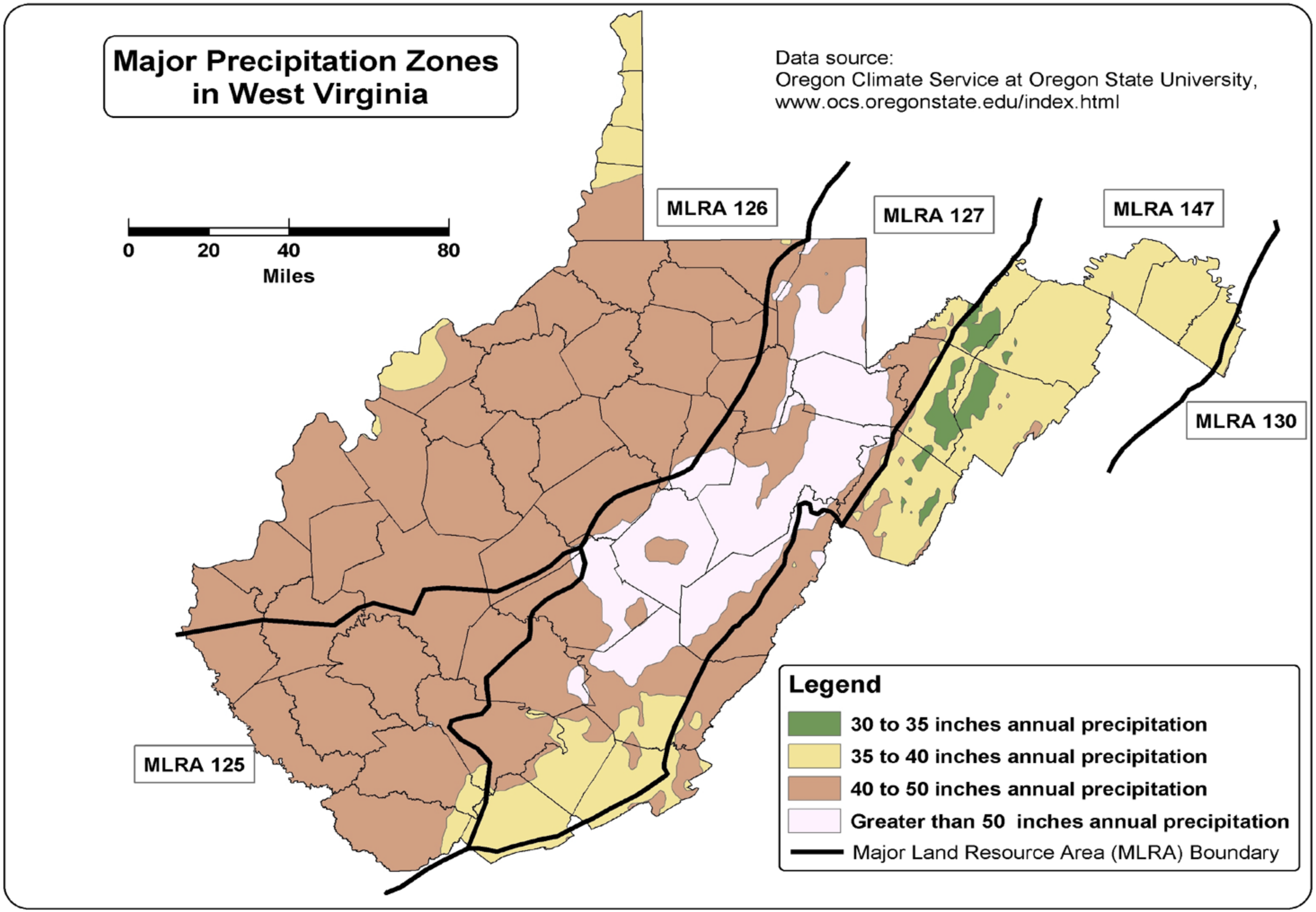
* - The 30-35” and the 35-40” zones differ only in production yields of forages.

40-50" Precipitation Zone

Precipitation averages about 42" to 45", primarily in the form of rain. May through September rainfall totals approximately 20". Distribution during the growing season is fairly even with the low occurring during October. Drought periods causing excessive growth stress are infrequent during the growing seasons. Seasonal droughts can be expected about once every ten years. Mean annual snowfall varies from 20-40" in the south, to 50-80" in the north. Snow cover, one inch or more, occurs on 25-45 days per year. Average frost free period is from 150 days in the north to 200 days south of Kanawha River. Mean maximum and minimum January temperatures are 47 and 25 degrees. Temperature extremes that have been recorded are 102°F to -25°F in the northern half of the zone, and 104°F to -10°F in the southern half. Mean maximum and minimum July temperatures are 88°F and 62°F. Elevation varies from 1,000 to 3,000 with the mean about 1500 feet.

50" Precipitation Zone

Normal precipitation ranges from 52-56" in most of the zone. This zone occurs in mountainous areas of the state at elevations above 2,500 to 3,000 feet. The major limiting factor is length of growing season which averages 90-130 days. The last killing frost in the spring is about May 20, the first in the fall is about September 30. Growing season rainfall is 24" or more, evenly distributed. Droughty periods during the growing season are infrequent and normally don't last long. Mean annual snowfall varies from 60 to 100" with some areas receiving from 120-160". Snow cover, one inch or more, occurs over 60 days a year. Mean maximum and minimum January temperatures are 43°F and 21°F. Mean July maximum and minimum temperatures are 8l°F and 55°F. Winter lows commonly go -10°F to -15°F below zero, with -25°F to -30°F to be expected on a 25-year frequency.


Major Precipitation Zones
in West Virginia
Data source:
Oregon Climate Service at Oregon State University,
www.ocs.oregonstate.edu/index.html
0
20
40
80
Miles
MLRA 126
MLRA 127
MLRA 147
MLRA 130
MLRA 125
Legend
30 to 35 inches annual precipitation
35 to 40 inches annual precipitation
40 to 50 inches annual precipitation
Greater than 50 inches annual precipitation
Major Land Resource Area (MLRA) Boundary

BRIEF GRASSLAND SUITABILITY GROUP DESCRIPTION
LEGEND FOR PERMANENT GRASSLANDS

Grassland Suitability Groups (GSG) are groupings of soils which have similar capabilities for growing adapted herbaceous plants and which will show a similar response to management. These groupings, when combined with climate and aspect, reflect the productive potential and provide a guide to conservation and management needs when permanent grassland is the land use objective. Groupings are listed in the order which indicates their relative productive potential. Aspect affects plant adaptation and the time of the year when growth occurs. The cooler, moister north aspect is usually more productive than the warmer, drier south aspect. Descriptions of the GSG's and the precipitation zone are given below.

	1	2	3	4
PRECIPITATION ZONE:	30-35"	35-40"	40-50"	Over 50"

WV GRASSLAND SUITABILITY GROUPS FOR PERMANENT GRASSLANDS

AH1 - Acid Hills - moderately deep, deep, and very deep moderately well and well drained soils with low natural fertility. Moderate to high soil moisture holding capacity with pH less than 5.3. Slope ranges 25 to 60 percent or 25 to 45 percent if severely eroded. Annual precipitation is 30 to 35 inches.

AH2 - Acid Hills - moderately deep, deep, and very deep moderately well and well drained soils with low natural fertility. Moderate to high soil moisture holding capacity with pH less than 5.3. Slope ranges 25 to 60 percent or 25 to 45 percent if severely eroded. Annual precipitation is 36 to 40 inches.

AH3 - Acid Hills - moderately deep, deep, and very deep moderately well and well drained soils with low natural fertility. Moderate to high soil moisture holding capacity with pH less than 5.3. Slope ranges 25 to 60 percent or 25 to 45 percent if severely eroded. Annual precipitation is 40 to 50 inches.

AH4 - Acid Hills - moderately deep, deep, and very deep moderately well and well drained soils with low natural fertility. Moderate to high soil moisture holding capacity with pH less than 5.3. Slope ranges 25 to 60 percent or 25 to 45 percent if severely eroded. Annual precipitation is greater than 50 inches.

AL1 - Acid Loams - moderately deep, deep, and very deep moderately well and well drained soils with low natural fertility. Moderate to high soil moisture holding capacity with pH less than 5.3. Slope ranges from 0 to 25 percent. Annual precipitation is 30 to 35 inches.

AL2 - Acid Loams - moderately deep, deep, and very deep moderately well and well drained soils with low natural fertility. Moderate to high soil moisture holding capacity with pH less than 5.3. Slope ranges from 0 to 25 percent. Annual precipitation is 36 to 40 inches.

AL3 - Acid Loams - moderately deep, deep, and very deep moderately well and well drained soils with low natural fertility. Moderate to high soil moisture holding capacity with pH less than 5.3. Slope ranges from 0 to 25 percent. Annual precipitation is 40 to 50 inches.

AL4 - Acid Loams - moderately deep, deep, and very deep moderately well and well drained soils with low natural fertility. Moderate to high soil moisture holding capacity with pH less than 5.3. Slope ranges from 0 to 25 percent. Annual precipitation is greater than 50 inches.

DH1 - Dry Hills - moderately deep, well drained soils with low natural fertility. Low moisture holding capacity with pH less than 5.3. Slope ranges from 25 to 45 percent, or 15 to 35 percent if severely eroded. Annual precipitation is 30 to 35 inches.

DH2 - Dry Hills - moderately deep, well drained soils with low natural fertility. Low moisture holding capacity with pH less than 5.3. Slope ranges from 25 to 45 percent, or 15 to 35 percent if severely eroded. Annual precipitation is 36 to 40 inches.

DH3 - Dry Hills - moderately deep, well drained soils with low natural fertility. Low moisture holding capacity with pH less than 5.3. Slope ranges from 25 to 45 percent, or 15 to 35 percent if severely eroded. Annual precipitation is 40 to 50 inches.

DH4 - Dry Hills - moderately deep, well drained soils with low natural fertility. Low moisture holding capacity with pH less than 5.3. Slope ranges from 25 to 45 percent, or 15 to 35 percent if severely eroded. Annual precipitation is over 50 inches.

DU1 - Dry Uplands - moderately deep, well drained soils with low natural fertility. Low moisture holding capacity with pH less than 5.3. Slope ranges from 0 to 25 percent, or 0 to 15 percent if severely eroded. Annual precipitation is 30 to 35 inches.

DU2 - Dry Uplands - moderately deep, well drained soils with low natural fertility. Low moisture holding capacity with pH less than 5.3. Slope ranges from 0 to 25 percent, or 0 to 15 percent if severely eroded. Annual precipitation is 36 to 40 inches.

DU3 - Dry Uplands - moderately deep, well drained soils with low natural fertility. Low moisture holding capacity with pH less than 5.3. Slope ranges from 0 to 25 percent, or 0 to 15 percent if severely eroded. Annual precipitation is 40 to 50 inches.

DU4 - Dry Uplands - moderately deep, well drained soils with low natural fertility. Low moisture holding capacity with pH less than 5.3. Slope ranges from 0 to 25 percent, or 0 to 15 percent if severely eroded. Annual precipitation is over 50 inches.

FH1 - Fertile Hills - moderately deep, deep, and very deep moderately well and well drained soils with moderate natural fertility. Moderate soil moisture holding capacity with pH greater than 5.3. Slope ranges from 25 to 60 percent or 25 to 45 percent if severely eroded. Annual precipitation is 30 to 35 inches.

FH2 - Fertile Hills - moderately deep, deep, and very deep moderately well and well drained soils with moderate natural fertility. Moderate soil moisture holding capacity with pH greater than 5.3. Slope ranges from 25 to 60 percent or 25 to 45 percent if severely eroded. Annual precipitation is 36 to 40 inches.

FH3 - Fertile Hills - moderately deep, deep, and very deep moderately well and well drained soils with moderate natural fertility. Moderate soil moisture holding capacity with pH greater than 5.3. Slope ranges from 25 to 60 percent or 25 to 45 percent if severely eroded. Annual precipitation is 40 to 50 inches.

FH4 - Fertile Hills - moderately deep, deep, and very deep moderately well and well drained soils with moderate natural fertility. Moderate soil moisture holding capacity with pH greater than 5.3. Slope ranges from 25 to 60 percent or 25 to 45 percent if severely eroded. Annual precipitation is greater than 50 inches.

FL1 - Fertile Loams - Moderately deep, deep, and very deep moderately well and well drained soils with moderate natural fertility. Moderate soil moisture holding capacity with pH greater than 5.3. Slope ranges from 0 to 25 percent. Annual precipitation is 30 to 35 inches.

FL2 - Fertile Loams - Moderately deep, deep, and very deep moderately well and well drained soils with moderate natural fertility. Moderate soil moisture holding capacity with pH greater than 5.3. Slope ranges from 0 to 25 percent. Annual precipitation is 36 to 40 inches.

FL3 - Fertile Loams - Moderately deep, deep, and very deep moderately well and well drained soils with moderate natural fertility. Moderate soil moisture holding capacity with pH greater than 5.3. Slope ranges from 0 to 25 percent. Annual precipitation is 40 to 50 inches.

FL4 - Fertile Loams - Moderately deep, deep, and very deep moderately well and well drained soils with moderate natural fertility. Moderate soil moisture holding capacity with pH greater than 5.3. Slope ranges from 0 to 25 percent. Annual precipitation is greater than 50 inches.

LH1 - Limy Hills - moderately deep, well drained soils with moderate to high natural fertility. Low to moderate moisture holding capacity with pH greater than 5.3. Slope ranges from 25 to 45 percent, or 15 to 35 percent if severely eroded. Annual precipitation is 30 to 35 inches.

LH2 - Limy Hills - moderately deep, well drained soils with moderate to high natural fertility. Low to moderate moisture holding capacity with pH greater than 5.3. Slope ranges from 25 to 45 percent, or 15 to 35 percent if severely eroded. Annual precipitation is 36 to 40 inches.

LH3 - Limy Hills - moderately deep, well drained soils with moderate to high natural fertility. Low to moderate moisture holding capacity with pH greater than 5.3. Slope ranges from 25 to 45 percent, or 15 to 35 percent if severely eroded. Annual precipitation is 40 to 50 inches.

LH4 - Limy Hills - moderately deep, well drained soils with moderate to high natural fertility. Low to moderate moisture holding capacity with pH greater than 5.3. Slope ranges from 25 to 45 percent, or 15 to 35 percent if severely eroded. Annual precipitation is over 50 inches.

LU1 - Limy Uplands - moderately deep, well drained soils, with moderate to high natural fertility. Low to moderate moisture holding capacity with pH greater than 5.3. Slope ranges from 0 to 25 percent, or 0 to 15 percent if severely eroded. Annual precipitation is 30 to 35 inches.

LU2 - Limy Uplands - moderately deep, well drained soils, with moderate to high natural fertility. Low to moderate moisture holding capacity with pH greater than 5.3. Slope ranges from 0 to 25 percent, or 0 to 15 percent if severely eroded. Annual precipitation is 36 to 40 inches.

LU3 - Limy Uplands - moderately deep, well drained soils, with moderate to high natural fertility. Low to moderate moisture holding capacity with pH greater than 5.3. Slope ranges from 0 to 25 percent, or 0 to 15 percent if severely eroded. Annual precipitation is 40 to 50 inches.

LU4 - Limy Uplands - moderately deep, well drained soils with moderate to high natural fertility. Low to moderate moisture holding capacity with pH greater than 5.3. Slope ranges from 0 to 25 percent, or 0 to 15 percent if severely eroded. Annual precipitation is over 50 inches.

MH1 - Moist Hills - Deep and very deep, well drained soils with high natural fertility. High soil moisture holding capacity with pH greater than 5.3. Slope ranges from 25 to 60 percent or 25 to 45 percent if severely eroded. Annual precipitation is 30 to 35 inches.

MH2 - Moist Hills - Deep and very deep, well drained soils with high natural fertility. High soil moisture holding capacity with pH greater than 5.3. Slope ranges from 25 to 60 percent or 25 to 45 percent if severely eroded. Annual precipitation is 36 to 40 inches.

MH3 - Moist Hills - Deep and very deep, well drained soils with high natural fertility. High soil moisture holding capacity with pH greater than 5.3. Slope ranges from 25 to 60 percent or 25 to 45 percent if severely eroded. Annual precipitation is 40 to 50 inches.

MH4 - Moist Hills - Deep and very deep, well drained soils with high natural fertility. High soil moisture holding capacity with pH greater than 5.3. Slope ranges from 25 to 60 percent or 25 to 45 percent if severely eroded. Annual precipitation is greater than 50 inches.

ML1 - Moist Loams - Deep and very deep, well drained soils with high natural fertility. High soil moisture holding capacity with pH greater than 5.3. Slope ranges from 0 to 25 percent. Annual precipitation is 30 to 35 inches.

ML2 - Moist Loams - Deep and very deep, well drained soils with high natural fertility. High soil moisture holding capacity with pH greater than 5.3. Slope ranges from 0 to 25 percent. Annual precipitation is 36 to 40 inches.

ML3 - Moist Loams - Deep and very deep, well drained soils with high natural fertility. High soil moisture holding capacity with pH greater than 5.3. Slope ranges from 0 to 25 percent. Annual precipitation is 40 to 50 inches.

ML4 - Moist Loams - Deep and very deep, well drained soils with high natural fertility. High soil moisture holding capacity with pH greater than 5.3. Slope ranges from 0 to 25 percent. Annual precipitation is greater than 50 inches.

NS - Not Suited - All other soils that have a combination of soil properties and climate limitations that make them not suited for forage production because adequate growth for forage use plus soil stabilization is normally not possible.

RA1 - Very Rocky Acid Soils - moderately deep, deep, and very deep well drained soils with low natural fertility. Moderate to high soil moisture holding capacity with pH below 5.3. Slope ranges from 0 to 25 percent. Surface stones range from 0.1 to 50%. Annual precipitation is 30 to 35 inches.

RA2 - Very Rocky Acid Soils - moderately deep, deep, and very deep well drained soils with low natural fertility. Moderate to high soil moisture holding capacity with pH below 5.3. Slope ranges from 0 to 25 percent. Surface stones range from 0.1 to 50%. Annual precipitation is 36 to 40 inches.

RA3 - Very Rocky Acid Soils - moderately deep, deep, and very deep well drained soils with low natural fertility. Moderate to high soil moisture holding capacity with pH below 5.3. Slope ranges from 0 to 25 percent. Surface stones range from 0.1 to 50%. Annual precipitation is 40 to 50 inches.

RA4 - Very Rocky Acid Soils - moderately deep, deep, and very deep well drained soils with low natural fertility. Moderate to high soil moisture holding capacity with pH below 5.3. Slope ranges from 0 to 25 percent. Surface stones range from 0.1 to 50%. Annual precipitation is greater than 50 inches.

RL1 - Very Rocky Limy Soils - moderately deep, deep, and very deep well drained soils with high natural fertility. Moderate to high soil moisture holding capacity with pH above 5.3. Slope ranges from 25 to 45 percent. Surface stones range from 0.1 to 50%. Annual precipitation is 30 to 35 inches.

RL2 - Very Rocky Limy Soils - moderately deep, deep, and very deep well drained soils with high natural fertility. Moderate to high soil moisture holding capacity with pH above 5.3. Slope ranges from 25 to 45 percent. Surface stones range from 0.1 to 50%. Annual precipitation is 36 to 40 inches.

RL3 - Very Rocky Limy Soils - moderately deep, deep, and very deep well drained soils with high natural fertility. Moderate to high soil moisture holding capacity with pH above 5.3. Slope ranges from 25 to 45 percent. Surface stones range from 0.1 to 50%. Annual precipitation is 40 to 50 inches.

RL4 - Very Rocky Limy Soils - moderately deep, deep, and very deep well drained soils with high natural fertility. Moderate to high soil moisture holding capacity with pH above 5.3. Slope ranges from 25 to 45 percent. Surface stones range from 0.1 to 50%. Annual precipitation is greater than 50 inches.

SA1 - Sands - deep and very deep, excessively drained soils with low natural fertility. Very low moisture holding capacity with pH below 5.3. Slopes range from 0 to 40 percent. Annual precipitation is 30 to 35 inches.

SA2 - Sands - deep and very deep, excessively drained soils with low natural fertility. Very low moisture holding capacity with pH below 5.3. Slopes range from 0 to 40 percent. Annual precipitation is 36 to 40 inches.

SA3 - Sands - deep and very deep, excessively drained soils with low natural fertility. Very low moisture holding capacity with pH below 5.3. Slopes range from 0 to 40 percent. Annual precipitation is 40 to 50 inches.

SA4 - Sands - deep and very deep, excessively drained soils with low natural fertility. Very low moisture holding capacity with pH below 5.3. Slopes range from 0 to 40 percent. Annual precipitation is over 50 inches.

SD1 - Droughty Shales - shallow, well drained soils with very low natural fertility. Very low moisture holding capacity with pH below 5.3. Slope ranges from 0 to 15 percent, or 0 to 8 percent if severely eroded. Annual precipitation is 30 to 35 inches.

SD2 - Droughty Shales - shallow, well drained soils with very low natural fertility. Very low moisture holding capacity with pH below 5.3. Slope ranges from 0 to 15 percent, or 0 to 8 percent if severely eroded. Annual precipitation is 36 to 40 inches.

SD3 - Droughty Shales - shallow, well drained soils with very low natural fertility. Very low moisture holding capacity with pH below 5.3. Slope ranges from 0 to 15 percent, or 0 to 8 percent if severely eroded. Annual precipitation is 40 to 50 inches.

SD4 - Droughty Shales - shallow, well drained soils with very low natural fertility. Very low moisture holding capacity with pH below 5.3. Slope ranges from 0 to 15 percent, or 0 to 8 percent if severely eroded. Annual precipitation is over 50 inches.

SH1 - Shale Hills - shallow, well drained soils with very low natural fertility. Very low moisture holding capacity with pH below 5.3. Slopes range from 15 to 35 percent slopes, or 8 to 25 percent if severely eroded. Annual precipitation is 30 to 35 inches.

SH2 - Shale Hills - shallow, well drained soils with very low natural fertility. Very low moisture holding capacity with pH below 5.3. Slopes range from 15 to 35 percent slopes, or 8 to 25 percent if severely eroded. Annual precipitation is 36 to 40 inches.

SH3 - Shale Hills - shallow, well drained soils with very low natural fertility. Very low moisture holding capacity with pH below 5.3. Slopes range from 15 to 35 percent slopes, or 8 to 25 percent if severely eroded. Annual precipitation is 40 to 50 inches.

SH4 - Shale Hills - shallow, well drained soils with very low natural fertility. Very low moisture holding capacity with pH below 5.3. Slopes range from 15 to 35 percent slopes, or 8 to 25 percent if severely eroded. Annual precipitation is over 50 inches.

W1 - Wetlands - very deep, poorly and very poorly drained soils with low to moderate natural fertility. High soil moisture holding capacity with pH ranging between 4.0 and 6.0. Annual precipitation is 30 to 35 inches.

W2 - Wetlands - very deep, poorly and very poorly drained soils low to moderate natural fertility. High soil moisture holding capacity with pH ranging between 4.0 and 6.0. Annual precipitation is 36 to 40 inches.

W3 - Wetlands - very deep, poorly and very poorly drained soils low to moderate natural fertility. High soil moisture holding capacity with pH ranging between 4.0 to 6.0. Annual precipitation is 40 to 50 inches.

W4 - Wetlands - very deep, poorly and very poorly drained soils low to moderate natural fertility. High soil moisture holding capacity with pH ranging between 4.0 to 6.0. Annual precipitation is greater than 50 inches.

ACID HILLS (AH)

RELATIVE GRASSLAND POTENTIAL: Fair

MAJOR PROBLEM: Soil stabilization, steep slopes, uniform use, soil treatment.

Soil Description

Well, moderately well, or artificially drained; 3.1 to 4.9 inch available moisture holding capacity within the effective rooting depth or up to 30" depth; average effective rooting depth exceeds 20"; average pH in the second horizon is lower than 5.3; clay loam, silty clay loam, silt loam, loam, fine sandy loam, or sandy loam surface texture; surface permeability .2-6.3 inches per hour; 0-.1% surface stones; low natural fertility; none to occasional flooding hazard. Steeper slope phases, 25-60%, or 25-45% if severely eroded are in this group.

Soil Series Characterizing This Group

Albrights	Allegheny	Berks	Blairton
Clymer	Dekalb	Ernest	Elliber
Gilpin	Laidig	Latham	Lily
Matewan	Muskingum	Pineville	Shelocta
Wharton	Zoar		

Climate - See precipitation zone descriptions

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yield per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame Pasture-(PTP)	EXCELLENT	High	5480	6090	7035	6825
	TYPICAL	Medium	2455	2730	3465	3465
	POOR	Low	660	735	945	1050
Native (Wildgrass) Pasture-(NP)	EXCELLENT	Improved	1890	2100	2520	2625
	TYPICAL	Natural	850	945	1260	1365
	POOR	Natural	380	420	735	945

Climatic fluctuations, primarily rainfall, have a significant effect on this group of soils causing annual yield variations up to 175% in the lower precipitation zones.

65-75% vegetative ground cover is typical when in Native Pasture.

Management

Minimum management required for soil stabilization and plant maintenance is higher than for Moist Hills or Fertile Hills because the situation is more critical. Adequate compensation in all practices should be planned.

(PTP) - Slope compounds the problem of PTP species. The soil pH needs to be raised before PTP species can be introduced and maintained. The steep slopes make liming questionable from both a physical and cost standpoint. In some situations the application of the recommended amount of phosphate plus a little extra to offset the phosphate tie up in the soil due to pH levels lower than 5.5 might be feasible, but in general if you can't get lime on, managing as PTP is questionable.

(ACID HILLS)

(NP) - Native species are as well adapted as on Fertile Hills. Palatability and quality will be slightly lower. This can be corrected by raising the phosphate level to medium. The economics of this may be questionable, though. Excellent condition native pasture should be the most economical use of this GSG where it is impractical to apply lime. Brush Control and Proper Pasture Management are required. Planned Grazing Systems are necessary to achieve proper grazing use.

ACID LOAMS (AL)

RELATIVE GRASSLAND POTENTIAL - Good

MAJOR PROBLEMS; Acid, less fertile soils

Soils Description

Well, moderately well, or artificially drained; 3.1 to 4.9 inch available moisture holding capacity within the effective rooting depth or up to 30" depth; average effective rooting depth exceeds 20"; average pH in the second horizon is lower than 5.3; clay loam, silty clay loam, silt loam, loam, fine sandy loam, or sandy loam surface texture; surface permeability .2-6.3 inches per hour; 0-.1% surface stones; low natural fertility; none to occasional flooding hazard. 0-25% slope.

Soil Series Characterizing This Group

Albrights	Allegheny	Basher	Berks
Blackthorn	Blairton	Buchanan	Captina
Calvin	Chavies	Clymer	Cookport
Cotaco	Craigsville	Dekalb	Downsville
Elliber	Ernest	Fenwick	Gilpin
Hustontown	Latham	Laidig	Lily
Lodi	Macove	Mandy	Meckesville
Mertz	Monongahela	Murrill	Muskingum
Pecktonville	Philo	Pineville	Pope
Potomac	Rayne	Shelocta	Shouns
Tilsit	Tygart	Wellston	Wharton
Zoar			

Climate - See precipitation zone descriptions

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yield per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame Pasture-(PTP)	EXCELLENT	High	6050	6720	7875	7560
	TYPICAL	Medium	3115	3465	4305	4305
	POOR	Low	945	1050	1365	1680
Native (Wildgrass) Pasture-(NP)	EXCELLENT	Improved	2080	2310	2835	2940
	TYPICAL	Natural	1135	1260	1470	1680
	POOR	Natural	660	735	1050	1260

60-80% vegetative cover is typical when in Native Pasture.

Management

Soils in this group differ from those in Fertile Loams in that they are lower in natural pH and fertility. More consideration must be given maintenance of adequate cover for soil stabilization, especially under lower levels of management.

(PTP) - It takes more lime and fertilizer to get yields comparable to Fertile Loams even though maximum potential is only slightly less. Thus producing PTP here can be significantly more costly. Once soil treatment is initiated and the species requiring this higher level of fertility and pH become established, a perpetuating lime and fertilizer maintenance schedule must be adhered to.

(ACID LOAMS)

(NP) - Same as Fertile Hills. In addition, proper grazing use becomes more critical as the plants are already under more stress due to site conditions. A higher degree of management efficiency is required to maintain adequate cover for conservation. Brush Control and Proper Pasture Management are required.

DRY HILLS (DH)

RELATIVE GRASSLAND POTENTIAL: Poor

MAJOR PROBLEMS: Soil erosion, low production, cost of production, over stocking, accessibility, maintaining permanent stand, steep slopes, droughtiness, soil treatment, etc.

Soils Description

Well, moderately well, or artificially drained; 2-3 inch available moisture holding capacity within the effective rooting depth or up to 30" depth; average effective rooting depth varies from 15-30"; average pH in the second horizon is lower than 5.3; clay loam, silty clay loam, silt loam, loam, fine sandy loam, or sandy loam surface texture; surface permeability .2-6.3 inches per hour; 0-.1% surface stones; low natural fertility; no flooding hazard; slope 25-45%, or 15-35% if severely eroded.

Soil Series Characterizing This Group

Berks	Calvin	Dekalb	Elliber
Lehew	Litz	Rushtown	Weikert

Climate - See precipitation zone description.

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yield per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame Pasture-(PTP)	EXCELLENT	High	3780	4200	5250	5355
	TYPICAL	Medium	1510	1680	2415	3045
	POOR	Low	285	315	945	945
Native (Wildgrass) Pasture-(NP)	EXCELLENT	Improved	1225	1365	1785	1890
	TYPICAL	Natural	565	630	840	1045
	POOR	Natural	135	150	315	630

55-70% vegetative ground cover is typical when in Native Pasture.

Management

All items mentioned in Dry Uplands become approximately twice as critical due to the increase in slope. Dry soil conditions are aggravated by loss of moisture due to increased runoff. Soils in this group must be managed very carefully from a conservation standpoint in either PTP or NP.

(PTP) - See Dry Uplands also. Higher cost is magnified due to lower production return per unit of input, making economics questionable. High levels of fertility are not considered desirable due to the extreme stress already placed on plants by the critical nature of the site. Erratic climate conditions are magnified by poor site conditions. Proper Pasture Management is extremely important and requires extra effort and ability to achieve.

(NP) - Native species are capable of maintaining adequate cover for soil stabilization and providing some grazing if they are allowed to naturally reseed (deferred grazing) once every four years. Production is very susceptible to climatic fluctuations, but to a lesser degree than PTP. All items mentioned in Dry Uplands apply, but become more binding. A grazing system which assures no more than 50% use of the total annual growth is required.

DRY UPLANDS (DU)

RELATIVE GRASSLAND POTENTIAL: Fair

MAJOR PROBLEMS: Dry, low productivity, maintaining cover

Soils Description

Well, moderately well, or artificially drained; 2-3 inch available moisture holding capacity within the effective rooting depth or up to 30" depth; average effective rooting depth varies from 15-30"; average pH in the second horizon is lower than 5.3; clay loam, silty clay loam, silt loam, loam, fine sandy loam, or sandy loam surface texture; surface permeability .2-6.3 inches per hour; 0-.1% surface stones; low natural fertility; no flooding hazard; slope 0-25%, or 0-15% if severely eroded.

Soil Series Characterizing This Group

Berks	Calvin	Clearbrook	Dekalb
Elliber	Lehew	Litz	Mandy
Rushtown	Weikert		

Climate - See precipitation zone description.

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. Yields may vary up to 200% from year to year in this group. The following total forage yield per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame Pasture-(PTP)	EXCELLENT	High	5010	5565	6510	6300
	TYPICAL	Medium	2365	2625	3465	3990
	POOR	Low	660	735	1050	1365
Native (Wildgrass) Pasture-(NP)	EXCELLENT	Improved	1700	1890	2205	2205
	TYPICAL	Natural	850	945	1260	1470
	POOR	Natural	380	420	630	945

60-75% vegetative ground cover is typical when in Native Pasture.

Management

Productive capacity is seriously restricted due to the low moisture holding capacity of these soils. It is approximately 1/2 of that of Moist Loams. Therefore, amount, intensity and timing of rainfall during the growing season becomes very important. If rainfall is adequate and dependable, as in the "over 50" precipitation zone, relatively good production can be expected. In other precipitation zones, conservation and management requirements are higher. Average soil depth varies from 10-20 inches. Well adapted species are limited. Resulting yields are reduced proportionately. Costs per unit of production go up. Seasonal production reliability is only fair.

(DRY UPLANDS)

(PTP) - Where lime and fertilizer can be applied, PTP species can be maintained. Special emphasis should be given to identifying and correctly using north and south exposures in a system. Selection of the best adapted species for the site is important. Timing and amount of fertilization and grazing management alternatives are limited, but become more critical. It takes "more of everything", to maintain a healthy vigorous sod. High levels of fertility may not be desirable due to the plants limited response capacity, and may cause undue stress on the plants. For example, high fertility levels can cause overgrazed plants to die rather than go dormant during a drought.

(NP) - Native species are well adapted and can maintain adequate cover for soil stabilization but production is lower than for Acid Loams due to the more droughty soils. Palatability and quality will definitely be lower, but can be improved by the addition of phosphate and/or lime. Cost and return of application needs to be evaluated closely to determine if the economics is desirable. Careful control of grazing use is required to avoid abuse as pasture condition can deteriorate rapidly when overgrazed. This site is susceptible to climatic and managerial fluctuations. Therefore, management expertise needs to be better than average. Improved, more intensive management and conservation practices are required.

FERTILE HILLS (FH)

RELATIVE GRASSLAND POTENTIAL: Good

MAJOR PROBLEMS: Steep slopes, stabilization, uniform grazing use.

Soils Description

Well, moderately well, or artificially drained; 3.1" to 4.9" of available moisture holding capacity in the rooting zone or up to 30" of depth; average rooting depth over 30" except for a few fragipan soils with a restricting layer at 26-28 inches; average pH in the second horizon 5.3 or higher; clay loam, silty clay loam, silt loam, loam, fine sandy loam, or sandy loam surface texture; surface permeability .2-6.3 inches per hour; 0-.1% surface stones; medium natural fertility; none to occasional flooding hazard. Slope - 25-60%, or 25-45% if severely eroded.

Soil Series Characterizing This Group

Barbour	Beech	Clarksburg
Dormont	Guernsey	Murill
Sciotoville	Peabody	Pickaway
Upshur	Vandalia	Westmoreland
Wheeling		

Climate - See precipitation zone descriptions.

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yields per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame Pasture-(PTP)	EXCELLENT	High	5670	6300	7350	6930
	TYPICAL	Medium	2640	2940	3675	3675
	POOR	Low	850	945	1050	1260
Native (Wildgrass) Pasture-(NP)	EXCELLENT	Improved	2175	2415	2625	2730
	TYPICAL	Natural	945	1050	1365	1470
	POOR	Natural	660	735	945	1050

Climatic fluctuations, primarily rainfall, have a limited effect on this group of soils, but may still cause annual yield variations up to 140% in the lower precipitation zones.

70-85% vegetative ground cover is typical when in Native Pasture.

Management

Because of the moisture holding capacity of these soils being lower, slope becomes more critical.

(PTP) - Potential productivity is harder and more expensive to achieve and management demands for maintenance and production are higher than for Moist Hills.

Upshur soils, due to their clayey texture, can become a critical erosion problem due to animal trampling, overgrazing, or other factors which may cause a loss of adequate cover. Special attention should be given to time of use, and Proper Pasture Management. The Corydon and Chilhowie soils are slightly droughtier than the other soils in this group. Compensating emphasis should be given to management of these soils where they are the primary soil type in a field.

(FERTILE HILLS)

(NP) - Productive more palatable species very well adapted. Limitations on use of conventional equipment for PTP management make the use of native species more acceptable. Minimum management requirements are Brush Control and Proper Pasture Management. Planned grazing systems are normally necessary to achieve proper pasture management.

FERTILE LOAMS (FL)

RELATIVE GRASSLAND POTENTIAL: Very Good

MAJOR PROBLEMS: Topography

Soils Description

Well, moderately well, or artificially drained; 3.1" to 4.9" of available moisture holding capacity in the rooting zone or up to 30" of depth; average rooting depth over 30" except for a few fragipan soils with a restricting layer at 26-28 inches; average pH in the second horizon 5.3 or higher; clay loam, silty clay loam, silt loam, loam, fine sandy loam, or sandy loam surface texture; surface permeability .2-6.3 inches per hour; 0-.1% surface stones; medium natural fertility; none to occasional flooding hazard. Slope - 0-25%.

Soil Series Characterizing This Group

Barbour	Beech	Captina	Chavies
Clarksburg	Conotton	Coolville	Dormont
Gallia	Glenford	Grigsby	Guernsey
Lawrence	Licking	Markland	Middlebury
Murrill	Omulga	Otwell	Peabody
Pickaway	Ryder	Sciotoville	Shircliff
Shouns	Skidmore	Tarhollow	Tioga
Upshur	Vandalia	Vincent	Westmoreland
Wheeling	Woodsfield		

Climate - See precipitation zone descriptions.

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yields per acre can be expected in normal years:

	Level of	Level of	Precipitation Zone			
Kind	Operation	Fertility	30-35	35-40	40-50	50+
Permanent Tame Pasture-(PTP)	EXCELLENT	High	6235	6930	8085	7665
	TYPICAL	Medium	3305	3675	4515	4620
	POOR	Low	1135	1260	1575	1785
Native (Wildgrass) Pasture-(NP)	EXCELLENT	Improved	2265	2520	2940	3045
	TYPICAL	Natural	1320	1470	1680	1785
	POOR	Natural	945	1050	1365	1575

Climatic fluctuations, primarily rainfall, have a limited effect on this group of soils, but may still cause annual yield variations up to 125% in the lower precipitation zones.

75-90% vegetative ground cover is typical when in Native Pasture.

Management

The main factor reducing productive potential is a moisture holding capacity approximately 25% less than Moist Loams. Thus reliability and maximum yields are reduced accordingly. This limitation does not seem to be very significant in the “over 50” precipitation zone. A few of the soils have a fragipan at 22 -28”, thus slightly reducing the potential of some deeper rooted species such as alfalfa. These soils are designated with a (FP) immediately behind the series in the soils listing by GSG.

(FERTILE LOAMS)

(PTP) – Conservation and management requirements are the same as for Moist Loams. Because of the lower inherent productive capacity, cost of production will be slightly higher at the higher levels of production, I.e., returns may not be as good. Normally, these soils will support adequate herbaceous vegetation for acceptable soil stabilization without soil treatment.

Exceptions can occur on fields where poor or excessive cropping, and the resulting erosion, has seriously depleted the natural fertility.
(NP) – Productive more palatable species very well adapted and production from natural fertility only is relatively good. Minimum management requirements are Brush Control and Proper Pasture Management.

LIMY HILLS (LH)

RELATIVE GRASSLAND POTENTIAL: Fair

MAJOR PROBLEMS: Slope and limited moisture holding capacity.

Soils Description

Except for the slope limits, the soil characteristics of this site are the same as those described for Limy Uplands. Well or moderately well drained; 2-3" of available moisture holding capacity in the rooting zone or up to 30" of depth; average rooting depth range 16-35 inches; average pH in the second horizon higher than 5.3;' silt loams, silty clay, and clay surface texture; surface permeability; .2-2.0 inches per hour; 0-.1% surface stones; medium natural fertility; no flooding hazard; slope 25-45% or 15-35% if severely eroded.

Soil Series Characterizing This Group

Brooke	Calvin	Caneyville	Carbo
Cateache	Chilhowie	Culleoka	Edom
Fairpoint	Janelew	Opequon	Teas

Climate - See precipitation zone description.

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yield per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame Pasture-(PTP)	EXCELLENT	High	3970	4410	5460	5565
	TYPICAL	Medium	1605	1785	2730	3255
	POOR	Low	470	525	840	1155
Native (Wildgrass) Pasture-(NP)	EXCELLENT	Improved	1415	1575	2100	2200
	TYPICAL	Natural	765	840	1050	1260
	POOR	Natural	380	420	525	840

65-80% vegetative ground cover is typical when in Native Pasture.

Management

All items mentioned in Limy Uplands become more critical or demanding due to the increased slope factor. Erosion hazard increases due to runoff and overgrazing. Use of conventional equipment is limited.

(PTP) - This soil is still very productive in the higher rainfall zones where extra moisture can overcome the limited moisture holding capacity. More dependable production can be expected from deeper rooted species. Adequate cover must be left on the ground to compensate for the increased runoff potential.

(NP) - Native species are all very well adapted to this site. Production is limited due to moisture. Brush Control and Proper Pasture Management are required. Planned grazing systems will usually be required to achieve proper grazing use.

LIMY UPLANDS (LU)

RELATIVE GRASSLAND POTENTIAL: Good

MAJOR PROBLEMS: Limited available moisture holding capacity.

Soils Description:

Well or moderately well drained; 2-3" of available moisture holding capacity in the rooting zone or up to 30" of depth; average rooting depth range 16-35 inches; average pH in the second horizon higher than 5.3;' silt loams, silty clay, and clay surface texture; surface permeability; .2-2.0 inches per hour; 0-.1% surface stones; medium natural fertility; no flooding hazard; slope 0-25% or 0-15% if severely eroded.

Soil Series Characterizing This Group

Brooke	Calvin	Caneyville	Carbo
Cateache	Chilhowie	Culleoka	Edom
Faywood	Opequon	Summers	Teas
Lowell			

Climate - See precipitation zone description.

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yield per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame Pasture-(PTP)	EXCELLENT	High	5195	5775	6720	6510
	TYPICAL	Medium	2455	2730	3780	4200
	POOR	Low	850	945	1260	1680
Native (Wildgrass) Pasture-(NP)	EXCELLENT	Improved	1890	2100	2520	2415
	TYPICAL	Natural	1135	1260	1470	1680
	POOR	Natural	660	735	945	1260

70-85% vegetative ground cover is typical when in Native Pasture.

Management

The factor making these soils less productive and more apt to have conservation and management problems than Fertile Loams is the approximately 50% lower available moisture holding capacity. Maintaining adequate cover for soil stabilization becomes more critical and requires a higher degree of effort to achieve.

(PTP) - Conservation and management requirements are essentially the same as for Fertile Loams, but due to the lower productivity potential will not respond as efficiently. Harvesting frequency will need to be reduced, as the ability to recover, especially during the drier growing period, is limited. Requirements for plant maintenance increases. Due to droughtier conditions, the deeper root grass species are more desirable than the shallow rooted species such as Kentucky Bluegrass.

(NP) - The productive more palatable species are still very well adapted. Production at natural fertility levels is relatively good, approaching yields equal to Fertile Loams in the higher rainfall zones. Brush Control and Proper Pasture Management are required.

MOIST HILLS (MH)

RELATIVE GRASSLAND POTENTIAL: Very Good

MAJOR PROBLEMS: Stabilizing and using steep slopes

Description

Well, moderately well or artificially drained; available moisture holding capacity, in the upper 30 inches of soil, 5" or greater; average pH in the second horizon 5.3 or better; clay loam, silty clay loam, silt loam, loam, fine sandy loam or sandy loam surface texture; average rooting depth 30" or more; surface permeability .2-6.3 inches per hour; 0-.1% surface stones. Slope – 25-60%, 25-45% if severely eroded.

Soil Series Characterizing This Group

Belmont	Brookside
Hagerstown	Duffield
Frankstown	Frederick

Climate – See precipitation zone descriptions.

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yields per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame Pasture-(PTP)	EXCELLENT	High	6800	7560	7840	7980
	TYPICAL	Medium	2930	3255	3885	3990
	POOR	Low	945	1050	1260	1365
Native (Wildgrass) Pasture-(NP)	EXCELLENT	Improved	2270	2520	2940	3045
	TYPICAL	Natural	1135	1260	1470	1680
	POOR	Natural	850	945	1050	1260

Climatic fluctuations, primarily rainfall, have a limited effect on this group of soils, but may still cause annual yield variations up to 135% in the lower precipitation zones.

85-95% vegetative ground cover is typical when in Native Pasture.

Management

Slope is the primary limiting factor.

(PTP) - Response to PTP management is very good. More intensive conservation practices such as strip seeding, mulch seeding, and sod seeding must be used during reseeding operations where conventional seeding is possible. Proper grazing management becomes more important, i.e., slightly more growth needs to be left on the surface for proper water conservation and optimum plant growth. Uniform use requires more fencing and water development efforts. Exposure affects special adaptation and time (season) of growth, and thus use.

Use of conventional equipment becomes increasingly less practical. To achieve high levels of management, aerial spraying, aerial fertilization, hand labor, specialized ground equipment, and other non-conventional techniques must be used.

Inputs required to achieve high levels of management and production increases. When these inputs, such a labor, time materials, physical improvements and management go up, cost per unit of production goes up.

(MOIST HILLS)

(NP) – Productive, more palatable species very well adapted. Limitations on use of conventional equipment for PTP management make the use of native species more acceptable. Minimum management requirements are Brush Control and Proper Pasture Management.

MOIST LOAMS (ML)

RELATIVE GRASSLAND POTENTIAL: Excellent

MAJOR PROBLEMS: Possible Flooding Soils

Description

Well, moderately well or artificially drained; available moisture holding capacity, in the upper 30 inches of soil, 5" or greater; average pH in the second horizon 5.3 or better; clay loam, silty clay loam, silt loam, loam, fine sandy loam or sandy loam surface texture; average rooting depth 30" or more; surface permeability .2-6.3 inches per hour; 0-.1% surface stones. Slope - 0-25%.

Soil Series Characterizing This Group

Ashton	Belmont	Benevola	Brookside
Chagrin	Combs	Duffield	Duncannon
Dunmore	Elk	Frankstown	Frederick
Funkstown	Gallipolis	Hackers	Hagerstown
Huntington	Kanawha	Landes	Lappans
Lindside	Lobdell	Massanetta	Moshannon
Nelse	Nolin	Orrville	Senecaville
Sensabaugh	Swanpond		

Climate - See precipitation zone descriptions.

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yields per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame Pasture-(PTP)	EXCELLENT	High	7560	8400	9240	8925
	TYPICAL	Medium	3685	4095	4830	4835
	POOR	Low	1415	1575	1785	1995
Native (Wildgrass) Pasture-(NP)	EXCELLENT	Improved	2550	2835	3255	3360
	TYPICAL	Natural	1415	1575	1785	2100
	POOR	Natural	1135	1260	1575	1785

Climatic fluctuations, primarily rainfall, have the least effect on this group of soils but may still cause annual yield variations up to 125% in the lower precipitation zones.

85-100% vegetative ground cover is typical when in Native Pasture.

Management

Soils in this grouping have the greatest potential for maximum response to management and soil treatment. Use of this group is highly flexible, and is a very desirable asset to any operating unit. Use alternatives vary from native pasture with natural fertility to Bermuda grass pasture with 600 lbs. of nitrogen applied annually. All sites are tillable; thus intensive management practices such as reseeding to establish more productive species and liming and fertilizing to improve production can be carried out with conventional techniques and equipment. Secondary use of these areas for hay and grass silage is practical as a way to utilize excess forage and increases production efficiency. Recovery after proper grazing use is rapid and dependable. More "harvests" can be removed than on other GSG's, without jeopardizing the permanency or productivity of the stand. The number of harvests depends on the intensity of the grazing system.

(MOIST LOAMS)

Possible flooding hazard on soils located next to streams and rivers limits such practices as reseeding, haying, etc. If the vegetation on these areas is inundated for relatively long periods during the growing season, flood tolerant plants should be used.

(PTP) - This is the best group for the more productive and tall growing desirable grasses and legumes. To achieve the production capacity potential, management specifically for the species used and soil involved should be applied. General recommendations are too broad when striving for the ultimate.

(NP) - This GSG is seldom used for Native Pasture, although desirable native species will reach their most productive capacity on these soils. Brush Control and Proper Pasture Management are required. Warm season native species such as switchgrass may be managed as PTP specifically for summer grazing. Initial results indicate 6 tons of forage per acre with these species is possible.

NOT SUITED FOR PASTURE (NS)

These soils are not considered to be suitable for use as pasture or grazing land. The factors causing this classification may be any combination of the following: cost of production, cost of soil stabilization (conservation needs), cost of maintenance (brush control, lime, fertilizer), or accessibility. Any removal of foliage may create critical soil and/or water resource deterioration. The NS rating results when the circumstances require effort and cost which causes the growing of plants for forage to be unpractical or unfeasible under the current standards of living and economic situation. NS does not imply that these soils do not have the physical capacity of supporting herbaceous growth. In almost every case herbaceous growth can be adequately sustained with site and/or climatic modification, if funds and labor are not limiting.

VERY ROCKY, ACID SOILS (RA)

RELATIVE GRASSLAND POTENTIAL: Fair

MAJOR PROBLEMS: Too rocky or stony to till, acid, low fertility soils

Soils Description

This grouping of soils consists of the very stony, extremely stony, and rubbly phases of the same soils which occur in suitability group Acid Loams. Well, moderately well, or artificially drained; 3.1 to 4.9 inch available moisture holding capacity within the effective rooting depth or up to 30" depth; average effective rooting depth exceeds 20"; average pH in the second horizon is lower than 5.3; clay loam, silty clay loam, silt loam, loam, fine sandy loam, or sandy loam surface texture; surface permeability .2-6.3 inches per hour; .1 to 50% surface stones; low natural fertility; none to occasional flooding hazard. Slopes may range from 0-60%, but most will occur in the 25-60% range.

Soil Characterizing This Group

Albrights	Beech	Bethesda	Berks
Blackthorn	Buchanan	Calvin	Cedarcreek
Cloverlick	Clymer	Cookport	Dekalb
Edgemont	Elliber	Ernest	Faywood
Fenwick	Gilpin	Hazleton	Highsplint
Jefferson	Kaymine	Laidig	Latham
Leatherbark	Leetonia	Lehew	Lily
Macove	Mandy	Matewan	Meckesville
Mertz	Muskingum	Oriskany	Pineville
Rayne	Sewell	Shelocta	Shouns
Schaffenaker	Sideling	Udorthents	Wharton

Climate - See precipitation zone description.

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yield per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame	EXCELLENT	High	4905	5455	7030	6715
Pasture-(PTP)	TYPICAL	Medium	2080	2310	3045	3360
	POOR	Low	660	735	1050	1050
Native (Wildgrass)	EXCELLENT	Improved	1600	1780	2095	2200
Pasture-(NP)	TYPICAL	Natural	660	735	945	1260
	POOR	Natural	375	420	630	630

55-65% vegetative ground cover is typical when in Native Pasture.

Management

The management requirements of this group are the same as those discussed for Acid Loams and Acid Hills. Because of the accessibility problems due to slope and rocky conditions, use of conventional equipment is almost entirely eliminated. Selected areas may be accessible, but have to be evaluated by careful on-site inspection.

(VERY ROCKY, ACID SOILS)

(PTP) – Due to equipment limitations and more acid conditions, PTP is generally considered marginal. Cost of developing and maintaining this type of pasture is high, making economics a key concern. A management hazard is treating only small accessible spots, with stocking based on the total boundary size. This normally leads to heavy overgrazing and subsequent soil erosion on the treated areas. Cover suitable for soil stabilization is much harder to maintain than for Very Rocky Limy Soils. Using this GSG for PTP requires sound, careful management.

(NP) – Native species will maintain adequate cover for soil stabilization, but production is less that for Very Rocky Limy Soils. Brush Control and Proper Pasture Management are necessary, and hard to achieve. Planned grazing systems are usually necessary. Because costs of production are limited to fencing, water development and brush control, these soils can be more economical in native pasture than in permanent tame pasture.

VERY ROCKY, LIMY SOILS (RL)

RELATIVE GRASSLAND POTENTIAL: Good

MAJOR PROBLEMS: Too rocky or stony to till

Soils Description

This grouping of soils consists of the very stony, extremely stony, or rubbly phases of the same soils which occur in suitability group Fertile Loams. Slopes may range from 0 to 60%, but most will occur in the 25 to 60% range. The soils are well, moderately well, or artificially drained; 3.1" to 4.9" of available moisture holding capacity in the rooting zone or up to 30" of depth; average rooting depth over 30" except for a few fragipan soils with a restricting layer at 26-28 inches; average pH in the second horizon 5.3 or higher; Fine earth surface texture of clay loam, silty clay loam, silt loam, loam, fine sandy loam, or sandy loam; surface permeability .2-6.3 inches per hour; .1 to 50% surface stones; medium natural fertility; none to occasional flooding hazard.

Soils Characterizing This Group

Belmont	Benevola	Calvin	Caneyville
Cateache	Chilhowie	Clarksburg	Clifton
Corydon	Duffield	Dunmore	Elliber
Fairpoint	Faywood	Fiveblock	Frankstown
Frederick	Hagerstown	Kaymine	Murrill
Meckesville	Myra	Opequon	Ryder
Udorthents	Upshur	Vandalia	

Climate - See precipitation zone description.

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yield per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame	EXCELLENT	High	5195	5775	7350	7035
Pasture-(PTP)	TYPICAL	Medium	2265	2520	3360	3675
	POOR	Low	850	945	1260	1260
Native (Wildgrass)	EXCELLENT	Improved	1885	2095	2310	2415
Pasture-(NP)	TYPICAL	Natural	945	1050	1365	1575
	POOR	Natural	565	630	945	945

50-60% vegetative cover is typical. Bare rock may occupy 20-35% when in Native Pasture.

Management

The management of this GSG is the same as discussed for Fertile Loams and Fertile Hills except that use of conventional equipment is normally completely eliminated. Selected areas may not have this limitation but has to be determined by careful on-site evaluation of each site.

(PTP) - These soils will respond to aerial fertilization and will support a satisfactory stand of Kentucky bluegrass and white clover if adequate P205 is applied. Application should allow 40-50 lbs. of P_2O_5 to be available annually. Once fertilization is started, it must be perpetuated. Brush control and uniform grazing distribution are the two primary management problems. Lack of suitable water development sites compounds distribution problems. Field size and planned grazing system designs are often dictated by water availability. A rotation type grazing system is usually the only practical way of achieving proper grazing use.

(VERY ROCKY, LIMY SOILS)

(NP) - Because of limited accessibility, this soil should have special consideration for use as Native Pasture. The "desirable" native species should be introduced as rapidly as possible to realize the full productive potential of these soils - without soil treatment. Brush Control and Proper Pasture Management are required. Planned grazing systems are normally necessary to achieve proper pasture management.

SANDS (Sa)

RELATIVE GRASSLAND POTENTIAL: Poor (Good if irrigated)

MAJOR PROBLEMS: Excessive drainage, coarse textured soil

Soils Description

Excessively drained; 1.5-2.0 inches of available moisture holding capacity in the upper 30" of soil; average pH of the second horizon, 5.0-5.5; loamy fine sand, loamy sand, or sand surface texture; average rooting depth over 30"; surface permeability in excess of 6.3-inches per hour; 0-.1% surface stones; low natural fertility; none to occasional flooding frequency; Slope - 0-25%.

Soil Series Characterizing This Group

Craigsville	Lakin	Pope	Potomac
Psamments	Leetonia	Yeager	Barbour

Climate - See precipitation zone descriptions.

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yield per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame Pasture-(PTP)	EXCELLENT	High	4065	4515	5250	5250
	TYPICAL	Medium	1510	1680	2100	2415
	POOR	Low	565	630	945	1365
Native (Wildgrass) Pasture-(NP)	EXCELLENT	Improved	1605	1785	2310	2520
	TYPICAL	Natural	660	735	945	1365
	POOR	Natural	375	420	630	735

50-65% vegetative ground cover is typical when in Native Pasture.

Management

The soils in this GSG are very droughty due to coarse soil texture, lack of organic matter content, and excessive drainage. Production is very unstable and unreliable. Only deep rooting, drought tolerant species should be used. Grassland potential can be raised to good with an adequate irrigation system.

(PTP) and (NP) - All management practices should recognize the limitations caused by excessive droughtiness and adjust accordingly, i.e., leave more residue, best for spring and fall use, good winter feeding area due to drainage and manure builds organic matter.

DROUGHTY SHALES (SD)

RELATIVE GRASSLAND POTENTIAL: Poor

MAJOR PROBLEMS: Droughty conditions, soil erosion, low erratic production, high cost of production, excessive overgrazing, maintenance of stands

Soils Description

Well or moderately well drained; less than 2 inch available moisture holding capacity within the effective rooting zone; average effective rooting depth is normally less than 15 inches; average pH in-the second horizon is less than 5.3; clay loam, silty clay loam, silt loam, loam, fine sandy loam, or sandy loam surface texture; surface permeability .2-6.3 inches per hour; class 0-.1% surface stones; low natural fertility; no flooding hazard; Slope 0-15% or 0-8% if severely eroded.

Soil Series Characterizing This Group

Berks	Klinesville	Litz
Rushtown	Weikert	

Climate - See precipitation zone descriptions.

Productivity Index – A Productivity Index for Droughty Shales is not given

Management

These soils have next to the poorest potential of any soils considered suitable for pasture. They are normally shallow, very droughty and/or severely eroded. The moisture holding capacity is very low, approximately-1/4 that of Moist Loams. Many acres are in pasture though, because of the large acres of land accessible to conventional equipment.

Maintenance of adequate cover for soil stabilization is very critical and difficult. "Desert" type management might best explain the "frame of mind" needed to properly manage these soils. The degree of grazing use must be restricted in order to maintain the larger accumulation of mulch (litter, etc.) needed to insulate the soil. Without this mulch, high temperature, excessive runoff, high evaporation rates all compound the inherent droughtiness of these sites. Shallow soils limit plant adaptation. Climatic extremes in temperature and rainfall have a far greater impact on this group than any other. Winter kill, frost heaving, drought death loss, etc., are common.

(PTP) - It is very doubtful that this group should be used for PTP except in a few special situations. Selecting species which can persist under these extreme stress conditions is more important than selecting species for yield. Production must be considered a by-product or secondary objective. High levels of fertility are not desirable unless supplemental water is available. Due to the erratic yields year to year, annual economics may or may not be desirable. Over the long run, economics may be at the breakeven point. Generally, the low intensity approach is most desirable.

(NP) - Native plants are capable of maintaining adequate cover for stabilization. Limited utilization is possible under a good grazing system. Quality and palatability can be improved with the addition of phosphate. Other points mentioned in NP section of Dry Uplands apply here also, but are considerably more critical and demanding.

SHALE HILLS (SH)

RELATIVE GRASSLAND POTENTIAL: Marginal

MAJOR PROBLEMS: Droughty conditions, soil erosion, low erratic production, high cost of production, excessive overgrazing, maintenance of stands

Soils Description

Except for slope limits, the characteristics of this site are the same as for Droughty Shales. Well or moderately well drained; less than 2 inch available moisture holding capacity within the effective rooting zone; average effective rooting depth is normally less than 15 inches; average pH in-the second horizon is less than 5.3; clay loam, silty clay loam, silt loam, loam, fine sandy loam, or sandy loam surface texture; surface permeability .2-6.3 inches per hour; 0-.1% surface stones; low natural fertility; no flooding hazard; Slope 15-35% or 8-25% if severely eroded.

Soil Series Characterizing This Group

Berks	Klinesville	Litz
Rushtown	Weikert	

Climate - See precipitation zone descriptions.

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yield per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame Pasture-(PTP)	EXCELLENT	High	2835	3150	4200	4200
	TYPICAL	Medium	755	840	1575	2415
	POOR	Low	110	125	315	630
Native (Wildgrass) Pasture-(NP)	EXCELLENT	Improved	945	1050	1365	1470
	TYPICAL	Natural	475	525	630	735
	POOR	Natural	65	75	105	420

40-60% vegetative ground cover is typical when in Native Pasture.

Management

All items covered in Dry Hills and Droughty Shales apply here also, but are more critical. This group is the most undesirable for grassland as far as soil and moisture are concerned. Only top management can maintain these areas in pasture without conservation problems. This group is almost unsuitable for grassland in the lower precipitation zones, while in the high rainfall areas, the problem of low available water capacity is reduced.

Although more productive in higher rainfall areas, the relative potential of this GSG to others in the same rainfall zone still applies. Most of the statements below are directed towards the less than 50" precipitation zone.

(SHALE HILLS)

Although adequate cover for soil conservation is possible, adequate yields for conservation and livestock use are not always possible. This will vary year by year, and season by season. Those using this group for either PTP or NP pasture should not count on an economical return. As in any GSG, this varies farm by farm depending on how these areas are integrated into the total management system. Also, in special cases, it may be desirable to use areas where there is no economic return because less money is lost by grazing these areas than any other available alternative such as feeding or selling part of the breeding herd. The primary management objective must be conservation.

(PTP) - Not considered desirable due to high cost of production and inconsistency of production. A grazing system which maintains a residue on the soil surface adequate for soil stabilization is a must. Low vigor, weak, unproductive short-lived stands and frequent reseeding is common. Loss of cover and resulting soil erosion are continuous conservation problems. Maintenance of desirable PTP species requires extremely careful fertility, pH, and grazing management. Amount of herbaceous growth that can be harvested for forage is limited due to plant requirements for growth and maintenance. A rotational grazing system should be used and grazing must not exceed 50% of the total annual growth.

(NP) - Even with adapted native species, production is limited. A rotational grazing system should be used and grazing must not exceed 50% of the total annual growth. NP is also very susceptible to drought fluctuations although less affected than PTP. Natural reseeding (deferred grazing) must occur every 3 to 4 years in order to maintain a satisfactory stand.

WETLANDS (W)

RELATIVE GRASSLAND POTENTIAL: Good

MAJOR PROBLEMS: Poor drainage

Soils Descriptions

Very poorly, poorly and the poorer end of somewhat poorly drained; 3.4-6.0 inches of available water holding capacity in the upper 30" of soil, average pH of the second horizon ranges from 4.0 to 6.0, a few may be above; clay loam, silty clay loam, silt loam, loam, fine/sandy loam, or sandy loam surface texture; average rooting depth 20"-or more; surface permeability .2-6.3 inches per hour; 0-.1% surface stones; moderate natural fertility; occasional to frequent flooding. Slope may range from 0-25% but are normally 0-3%.

Soil Series Characterizing This Group

Andover	Armagh	Atkins	Blago
Brinkerton	Captina	Cavode	Dunning
Elkins	Fairplay	Fluvaquents	Ginat
Guyan	Holly	Lickdale	McGary
Melvin	Nolo	Orrville	Purdy
Robertsville	Sees	Taggart	Toms
Trussel	Tygart	Tyler	Wyatt

Climate - See precipitation zone descriptions.

Productivity Index - Total Pounds Air Dry Weight Per Acre

Production varies due to pasture condition, fertility level and precipitation zone. The following total forage yield per acre can be expected in normal years:

Kind	Level of Operation	Level of Fertility	Precipitation Zone 30-35	35-40	40-50	50+
Permanent Tame Pasture-(PTP)	EXCELLENT	High	5860	6510	6300	6090
	TYPICAL	Medium	2740	3045	2940	2730
	POOR	Low	1225	1365	1680	1575
Native (Wildgrass) Pasture-(NP)	EXCELLENT	Improved	2550	2835	3150	3045
	TYPICAL	Natural	1225	1365	1575	1575
	POOR	Natural	945	1050	1365	1365

90-100% vegetative cover is typical when in Native Pasture.

Management

Excessive wetness is the primary limiting factor that causes these soils to be grouped together. Consider this site a special use area. Adapted species, time of use, and cultural treatment is definitely restricted. Pastures on these soils are slow to greenup in the spring. Excessive water can be an asset if sites are used for summer pasture, especially in the 30-40" precipitation zone.

(PTP) - Reed canarygrass is the species best suited. Tall fescue does well, but the disorder "fescue foot" is strongly associated with fescue on wetlands. Responds to all levels of management but maximum potential is reduced because of wetness.

(NP) - Very few of these areas are managed as native pasture because they are the more inaccessible areas. Natural fertility is adequate to support a good stand. Raising the phosphate level to medium will improve quality, palatability and production. Brush Control and Proper Pasture Management are required.

National Park Service
U.S. Department of the Interior

Northeast Region
Philadelphia, Pennsylvania

Vegetation Classification and Mapping of Gauley River National Recreation Area, West Virginia

Technical Report NPS/NER/NRTR—2010/148

ON THE COVER
Gauley River, flowing past the Canyon Doors, May 2009.
Photograph by: Brian P. Streets.

Vegetation Classification and Mapping of Gauley River National Recreation Area, West Virginia

Technical Report NPS/NER/NRTR—2010/148

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Vegetation plots were sampled in 1995 by Nancy Putnam, Clif Tipton, Robert Hunsucker, Rose Sullivan, John Davis, Catherine Byer, and Dean Walton. Field assistance in 2005–2009 was provided by Celeste Good, Greg Short, Elizabeth Byers, and Stephanie Perles. Bryophyte collections were identified by Susan Studlar. Lichen collections were identified by Don Flenniken. John Bender developed the ELU model for the study area. Beth Eastman, James Jeuck, and Hugh Devine assisted with aerial imagery processing and accuracy assessment. Mark Hall, Milo Pyne, and Lesley Sneddon assisted with the crosswalk to the USNVC. Mary Russo assisted with data management in central Biotics, NatureServe. John Perez, Ken Stephens, Andy Steele, John Karish, Kristina Callahan, and Jennifer Keefer assisted with contracting, logistics, and project review. Cliff Bobinski provided safe passage through the rapids.

Executive Summary

A vegetation classification and map were developed for Gauley River National Recreation Area (GARI) by the West Virginia Natural Heritage Program following standards of the U.S. Geological Survey / National Park Service Vegetation Mapping Program. Standards include a minimum mapping unit of 0.5 ha (1.23 ac) and classification accuracy of 80% or greater for each map class. The U.S. National Vegetation Classification (USNVC) was used as the standard for vegetation classification.

Classification was based, in part, on multivariate analysis of complete floristic data from 220 plots sampled in 1995–2009. Plots were stratified to cover the geographic range and ecological gradients within the park. Multivariate analyses of plot data included hierarchical agglomerative cluster analysis, non-metric multidimensional scaling, and indicator species analysis. The classification for the park was crosswalked to the USNVC in consultation with NatureServe.

Vegetation of the park is classified in 23 associations of the USNVC, including 14 upland associations and 9 riparian and wetland associations. Prevailing physiognomic expressions include 17 forest associations, one woodland association, three herbaceous associations, one non-vascular association, and one sparse vegetation association. Two riparian associations new to the USNVC, the Riverscour Shrub Prairie and the (Virginia, Pitch) Pine Floodplain Forest, are recognized and described for the first time based on plots from GARI and from other rivers in West Virginia.

A digital vegetation map for GARI was developed as a personal geodatabase using Environmental Systems Research Institute (ESRI) ArcGIS software. The geodatabase includes a point feature class for locations of plots and two polygon-feature classes (clipped by the park boundary and unclipped) for vegetation, including non-vegetated land cover. Delineation of vegetation map classes was based on interpretation of a digital orthophoto mosaic developed by North Carolina State University (NCSU) from leaf-off color infrared aerial photography flown in March 2003.

The vegetation map includes 31 map classes. Upland communities comprise about 86% of the park area and are represented by 13 map classes. Two upland map classes each include patches of two associations, all others represent single associations. Six major upland forest associations (Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest, Sugar Maple - Yellow Buckeye - American Basswood Forest, Oak - Hickory Forest, Oak - Hickory - Sugar Maple Forest, Eastern Hemlock Plateau Forest, and Oak / Great Laurel Forest) comprise about 80% of the park area. Riparian and wetland communities comprise about two percent of the park area and are represented by nine map classes. One riparian map class is comprised of multiple associations, all others represent single associations. Six percent of the park is mapped as natural waterways, and the remaining five percent is mapped as disturbed areas and cultural and transportation features.

Spatial and thematic accuracy assessments were performed by NCSU. Thematic accuracy of 23 map classes was assessed, excluding seven non-vegetated map classes and one vegetation map class known from just one polygon. Producer’s and user’s accuracies of individual map classes range from 33% to100%. Overall thematic accuracy of the vegetation map is estimated to be 87.1%.

Introduction

This report describes vegetation classification and mapping of Gauley River National Recreation Area (GARI) in south-central West Virginia. This project fulfills an important goal of the National Park Service Inventory and Monitoring Program and was completed following standards of the U.S. Geological Survey (USGS) / National Park Service (NPS) Vegetation Mapping Program (USGS 2001).

USGS / NPS Vegetation Mapping Program products meet Federal Geographic Data Committee (FGDC) standards for vegetation classification, metadata, and spatial accuracy (FGDC 1997, 1998a, 1998b). Other standards include a minimum mapping unit of 0.5 ha (1.23 ac) and classification accuracy of 80% or greater for each map class. The U.S. National Vegetation Classification (USNVC), maintained by NatureServe, is the standard for vegetation classification.

The USNVC represents the terrestrial component in the U.S. of an International Classification of Ecological Communities (Grossman et al. 1998). Ecological communities are classified and mapped to serve as a “coarse filter” for conservation of biological diversity. Although plants are used to classify terrestrial ecological communities, these units also include and represent habitat for species in all kingdoms.

The USNVC is a hierarchical system which uses physiognomy to define the coarsest levels and floristic composition to define the finest levels of the classification (Grossman et al. 1998). The vegetation classification and map presented here for GARI utilize the finest level of the USNVC, the association, as the basic unit. The association is floristically based, and is named and described based on dominant and diagnostic plant species. Dominant species are those with the highest cover in each stratum (canopy layer) of vegetation. Diagnostic species are those which differentiate a community from others, either by abundance, constancy, or fidelity. Thus, a typical plant association may be named after dominants of one or two strata (species in the same stratum are divided by a dash, species in different strata are divided by a forward slash) with or without diagnostic taxa added for further refinement. For example *Platanus occidentalis - Betula nigra / Cornus amomum / (Andropogon gerardii, Chasmanthium latifolium)* Temporarily Flooded Woodland indicates a riparian woodland community where the tree canopy is typically dominated by American sycamore (*Platanus occidentalis*) and river birch (*Betula nigra*), the shrub layer is characterized by silky dogwood (*Cornus amomum*), and big bluestem (*Andropogon gerardii*) and/or Indian woodoats (*Chasmanthium latifolium*) have high constancy in the herb layer. Nominate species in parentheses are those which may be important in some examples or geographical range but which may be uncommon or absent in others. Because the USNVC covers a broad geographic range, the association names may not always represent local vegetation very well; it is important to consider the entire concept, including the local description for the association.

This report and related database products also use local, park-specific, GARI community type names for each association. For the example above, the GARI community type name is American Sycamore - River Birch Riverscour Woodland. Throughout the main body of this report associations are referred to by the GARI community type name. Corresponding scientific

names and alphanumeric identifiers (CEGL codes) for associations in the USNVC are listed in tables and are used in some of the appendixes to this report. The terms “association” and “community type” are conceptually synonymous within the scope of this report.

Relationships between community types and map classes are usually one-to-one, but can sometimes be more complex. Most map classes for natural and semi-natural vegetation are more-or-less equivalent (excluding ectotones, inclusions, and errors) to community types (and corresponding USNVC associations) and these are named by the corresponding GARI community type name. However, due to patchiness of vegetation or mapping constraints of scale and/or photointerpretation, some map classes include multiple community types. For example, patches of the American Sycamore - River Birch Riverscour Woodland are mapped as a distinct map class when they can be delineated from air photos, but small patches are also included along with patches of two other community types in the Riparian Zone map class. Additional map classes that do not correspond to classified GARI community types include aquatic, cultural, and disturbed areas and features.

Vegetation classification and mapping for GARI was completed by the West Virginia Natural Heritage Program (WVNHP), part of the Wildlife Resources Section of the WV Division of Natural Resources (WVDNR). WVNHP classifies, conducts inventories for, maps, and maintains databases on the natural biological diversity of the state, including natural ecological communities and rare plants and animals. North Carolina State University (NCSU) Center for Earth Observation provided supporting products and services for this project, including development of a digital orthophoto mosaic and performance of spatial and thematic accuracy assessment. NatureServe, a private non-profit organization serving as the network coordinator for Natural Heritage Programs throughout the Americas, assisted with the crosswalk to the USNVC. While contributing to the needs of the NPS, this project has also developed tools and information which can be applied to classification, mapping, and conservation of natural communities on public and private lands throughout the state and region.

Study Area

The Gauley River National Recreation Area (GARI), established as a unit of the NPS in 1988, is located in Fayette and Nicholas counties in south-central West Virginia (Figure 1). The proclamation boundary of the park encompasses approximately 4,555 ha (11,257 ac), but currently only about 1,845 ha (4,559 ac) are in federal ownership. The park and its vicinity are mapped on the Ansted and Summersville Dam USGS 1:24,000 topographic maps. Elevations in the park range from 207–611 m (679–2,005 ft).

Ecoregional assignment of the park varies depending on the mapping system and version used. The U. S. Forest Service (Keys et al. 1995) includes the park in the Western Coal Fields (M221Ca) and Eastern Coal Fields (M221Cb) Subsections of the Northern Cumberland Mountains Section (M221C). Another ecoregion map produced by the U. S. Forest Service (Bailey et al. 1994) places the park in the Allegheny Mountains Section (M221B) and Cumberland Mountains Section (M221c) of the Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow Province. The Nature Conservancy (TNC) (2009) places the park in the Cumberlands and Southern Ridge and Valley Ecoregion. The U. S. Environmental Protection Agency (USEPA) (Woods et al. 2003) includes the park in the Dissected Appalachian Plateau and in the Forested Hills and Mountains Level 3 Ecoregions, both of which are nested within the Central Appalachians Level 4 Ecoregion.

The climate of the park is a humid continental type characterized by marked seasonal temperature changes and relatively uniform precipitation throughout the year. Mean monthly temperature normals at nearby Summersville Lake (elevation 536 m [1760 ft]) range from -1.78° C (28.8°F) in January to 21.39° C (70.5° F) in July (NOAA 2002). Normal annual precipitation at Summersville Lake is 120.60 cm (47.48 in) and monthly precipitation normals range from 7.75 cm (3.05 in) in February to 14.05 cm (5.53 in) in July (NOAA 2002).

Bedrock geology of the park is mapped as the New River and Kanawha formations of the Pottsville group (Cardwell et al. 1968). These are nearly horizontal strata consisting of Pennsylvanian-aged sedimentary rocks. The older New River formation is primarily sandstone with some shale, siltstone, and coal. It is capped by the resistant, cliff-forming Nuttall sandstone. The New River formation is exposed in all topographic positions in the eastern end of the park and has weathered to form rolling plateaus dissected by shallow, steep-sided gorges with prominent cliff bands overlooking bedrock and boulder controlled rapids in the river channels. The younger Kanawha formation is approximately 50% sandstone with lesser amounts of shale, siltstone, and coal. The Kanawha formation lies on top of the New River formation and its exposures become more extensive in the uplands of the western end of the park. The Kanawha formation is less resistant than the New River formation and its landforms have greater topographic relief characterized by ridges rather than plateaus.

The park surrounds a 40-km (25-mi) reach of the Gauley River downstream from Summersville Dam and a 9-km (6-mi) reach of the Meadow River upstream from its confluence with the Gauley River. The Gauley and Meadow rivers are Rosgen type B2/1c streams (Bennett and McDonald 2006). Type B2/1c streams have less than two percent slope, have moderate width/depth ratios, are moderately entrenched, are dominated by boulders with bedrock controls,

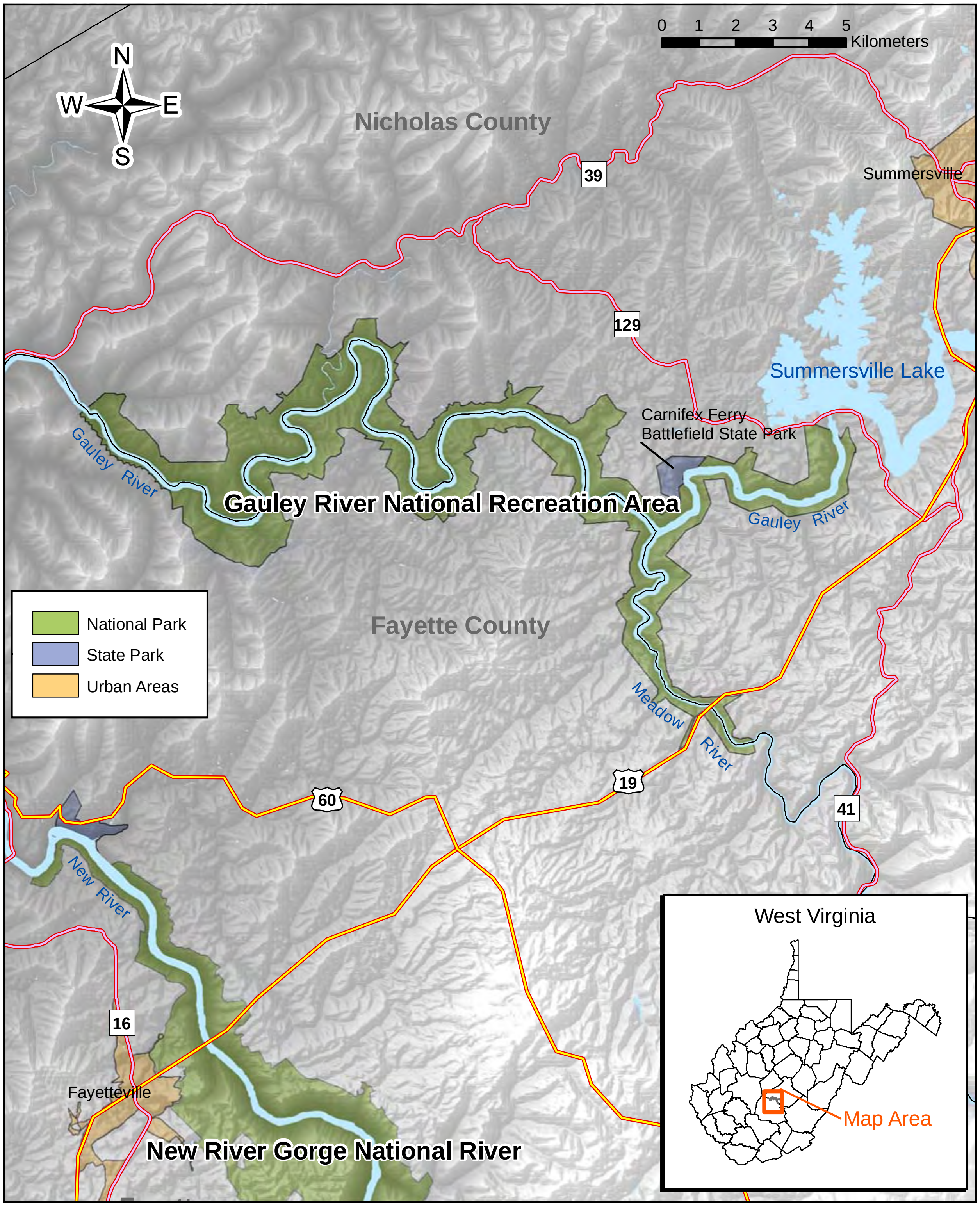

Figure 1. Gauley River National Recreation Area and vicinity in Fayette and Nicholas Counties, West Virginia.

and have bed features that often produce extensive rapids (Rosgen 1996). Since 1966, flows of the Gauley River have been regulated by Summersville Dam, just upstream from the park. Summersville Dam was constructed for flood control purposes, but since 1985, releases from the dam have also been scheduled around weekends in September and October to facilitate a white-water boating industry on the Gauley River. The Meadow River is a free-flowing river but peak flows in the park are somewhat moderated by a large wetland complex about 50 km (31 mi) upstream (Bennett and McDonald 2006).

Soils in the park are mapped by USDA Soil Conservation Service soil surveys of Fayette and Nicholas counties, which use somewhat different taxonomic systems. In Fayette County (Gorman and Espy 1975), soils are mapped as the Dekalb-Gilpin-Ernest association in the eastern three-quarters of the park and as the Muskingum-Shelocta association in the western one-quarter of the park. In Nicholas County (Carpenter 1992), soils are mapped as Gilpin-Buchanan in the eastern three-quarters of the park and as Gilpin-Pineville-Lily-Buchanan in the western one-quarter of the park.

GARI is included in the mixed mesophytic region of the eastern deciduous forest biome (Braun 1950). The vegetation of the park is characterized by extensive upland deciduous and mixed evergreen-deciduous forests with smaller areas of cliff and riparian habitats. Most forests in the eastern two-thirds of the park have a large component of eastern hemlock (*Tsuga canadensis*), while those in the western third are primarily deciduous. Common upland trees include (in decreasing order of frequency) red maple (*Acer rubrum*), eastern hemlock, tuliptree (*Liriodendron tulipifera*), blackgum (*Nyssa sylvatica*), northern red oak (*Quercus rubra*), American holly (*Ilex opaca* var. *opaca*), sweet birch (*Betula lenta*), white oak (*Quercus alba*), American beech (*Fagus grandifolia*), sourwood (*Oxydendrum arboreu*m), sugar maple (*Acer saccharum* var. *saccharum*), chestnut oak (*Quercus prinus*), sassafras (*Sassafras albidum*), white ash (*Fraxinus americana*), mockernut hickory (*Carya alba*), black oak (*Quercus velutina*), mountain magnolia (*Magnolia fraseri*), and cucumber-tree (*Magnolia acuminata*). Many forested areas, especially in the eastern end of the park, have nearly impenetrable shrub layers dominated by great laurel (*Rhododendron maximum*). Additional trees that are common in riparian habitats include river birch (*Betula nigra*), American sycamore (*Platanus occidentalis*), and sweet gum (*Liquidambar styraciflua*). The riparian habitats in the park are especially distinctive and harbor a high concentration of rare herb and shrub species, including the federally listed threatened Virginia meadowsweet (*Spiraea virginiana*).

The forests in GARI are almost entirely second or third growth following logging but a few remnant trees and small old growth patches occur in the park and in adjacent Carnifex Ferry Battlefield State Park (Fortney et al. 1995). Prior to 1885, logging was limited to areas near the river, which facilitated removal of logs by drifting, but after 1885, the building of railroads and large band mills opened up more extensive lands to logging (Brooks 1910). Some federally owned tracts were logged just prior to acquisition and some private holdings within GARI were logged even more recently.

Several botany and vegetation studies have been conducted at GARI but the reports covering these studies are mostly unpublished. Norris (1992) surveyed the park and reported on populations of 11 rare plant species. The WVNHP (2004) resurveyed the park in 2003, focusing on nine rare plant species identified in the Norris (1992) report. A recovery plan for Virginia

spiraea (Ogle 1991) provides some site-specific information on the discovery and occurrence of this threatened species in the park. The WVDNR continues to monitor populations of Virginia spiraea in the park (Harmon et al. 2009). Grafton (1993) tallied plant species frequencies and identified forest cover types along seven transects in the park. Fortney et al. (1995) conducted a reconnaissance vegetation study focusing on tree species that included two plots and a tree core sampling site within GARI and three plots along a transect in Carnifex Ferry Battlefield State Park. The WVNHP (Walton and Anderson 1997) sampled 30 vegetation plots in riparian areas of the park and recognized five community types. Wood (1999) established permanent plots in the gorge of the Meadow River in GARI and in Carnifex Ferry Battlefield State Park to monitor plant communities dominated by eastern hemlock which are threatened by the hemlock woolly adelgid (*Adelges tsugae*), a nonnative insect pest. The hemlock woolly adelgid was first detected at GARI in 2004 and infestations had increased by 2006, but tree mortality attributable to this pest was not yet evident in 2007 (Wood et al. 2009). A floristic inventory of GARI (Streets and Vanderhorst 2010) was conducted in concurrence with the vegetation classification and mapping described in this report.

Methods

Vegetation Classification

The vegetation classification for GARI was based, in part, on multivariate analysis of floristic plot data. The WVNHP sampled 30 plots in 1995 for a study of riparian vegetation in GARI (Walton and Anderson 1997) and three plots in 2000 in an old growth forest in Carnifex Ferry Battlefield State Park adjacent to GARI. These two data sets were incorporated into our analysis and an additional 187 plots were sampled in or near the park during the growing seasons of 2006 through 2009.

Landform and ecological land unit (ELU) models were developed for the park to assist with plot stratification. These models were developed using ArcGIS following AML code developed by TNC (Biasi 2001) with modifications appropriate for the study area (Bender 2003). The landform model was developed from a 30-m digital elevation model, using moisture and topographic position indices combined with slope and aspect to classify 14 landform types (steep slope N/NE, steep slope S/SW, slope crest, upper slope, flat summit/ridge, sideslope N/NE, cove/ravine N/NE, sideslope S/SW, cove/ravine S/SW, dry flat, moist flat, slope bottom, stream, and river). The ELU model combines the 14 landforms with two elevation classes (<427 m and ≥427 m [<1,400 ft and ≥1,400 ft]) to classify 28 units which occur in the park (Table 1). ELU types and locations of the 220 plots sampled for this project are mapped in Figure 2.

Running tallies of plots sampled within each ELU type were maintained, and an attempt was made to stratify plot sampling in ELU types in proportion to the area and community diversity within the ELU type. Representative polygons of undersampled ELU types were selected in the office using GIS, and GPS units were used in the field to navigate to these polygons to sample plots. Despite this, due to poor GPS reception and other logistical difficulties, some uncommon ELU types were not sampled, and there is some sampling inequity among more common types (Table 1). Due to the scale and precision of the digital elevation model, many areas of floodplain were classified as river, explaining the high number of plots sampled in ELU type 1142. No attempt was made to sample the two stream ELU types (1140 and 2140). A concerted effort was made to sample the two moist flat ELU types (1131 and 2131), which are the rarest ELU types in GARI, but this attempt revealed the spatial accuracy limitations of the ELU model. Using GPS, we navigated to three polygons of ELU 2131 and to one polygon of ELU 1131; however, arriving at the sites, we found wetland vegetation nearby but not within the mapped ELU. The ELU model accurately predicted the presence of the wet flat landform in the vicinity, but the ELU was offset from the actual location of the landform on the ground. In these cases, we sampled the wetland rather than the location of the ELU. This issue was less critical for more common ELU types which cover larger areas; in these cases, we tried to sample away from the boundaries of different ELU types. Plots were also sampled to document unique vegetation types which were recognized in the field or from aerial imagery.

Methods for sampling plots for this project are consistent with standards of the U.S. Geological Survey / National Park Service Vegetation Mapping Program (TNC and ESRI 1994a) , the Ecological Society of America (ESA) (2004), and the FGDC (2008). The vegetation plot field

Table 1. Ecological Land Unit (ELU) codes, specifications, area, and plot sampling stratification for Gauley River National Recreation Area (GARI). ELUs are listed in decreasing order of abundance (hectares) within the GARI proclamation boundary.

ELU Code	Elevation	Landform	Hectares	# Plots Sampled
1123	< 427 m	cove/ravine S/SW	428.97	14
1121	< 427 m	cove/ravine N/NE	379.21	17
2114	≥ 427 m	flat summit/ridge	334.59	8
1133	< 427 m	slope bottom	329.97	34
1142	< 427 m	river	297.87	26
2113	≥ 427 m	upper slope	250.4	9
1113	< 427 m	upper slope	245.72	10
2123	≥ 427 m	cover/ravine S/SW	223.35	6
2130	≥ 427 m	dry flat	222.69	8
1110	< 427 m	steep slope N/NE	222.45	5
2133	≥ 427 m	slope bottom	208.25	12
2121	≥ 427 m	cove/ravine N/NE	201.13	9
1111	< 427 m	steep slope S/SW	192.62	5
1114	< 427 m	flat summit/ridge	190.58	8
1130	< 427 m	dry flat	162.93	11
2112	≥ 427 m	slope crest	103.90	6
1112	< 427 m	slope crest	88.54	4
1122	< 427 m	sideslope S/SW	87.20	4
2110	≥ 427 m	steep slope N/NE	72.42	5
1120	< 427 m	sideslope N/NE	70.15	6
2120	≥ 427 m	sideslope N/NE	67.98	3
2122	≥ 427 m	sideslope S/SW	67.86	4
2111	≥ 427 m	steep slope S/SW	53.74	3
2142	≥ 427 m	river	18.03	2
1140	< 427 m	stream	16.72	0
2140	≥ 427 m	stream	10.53	0
1131	< 427 m	moist flat	4.25	1
2131	≥ 427 m	moist flat	3.66	0
Totals			4555.71	220

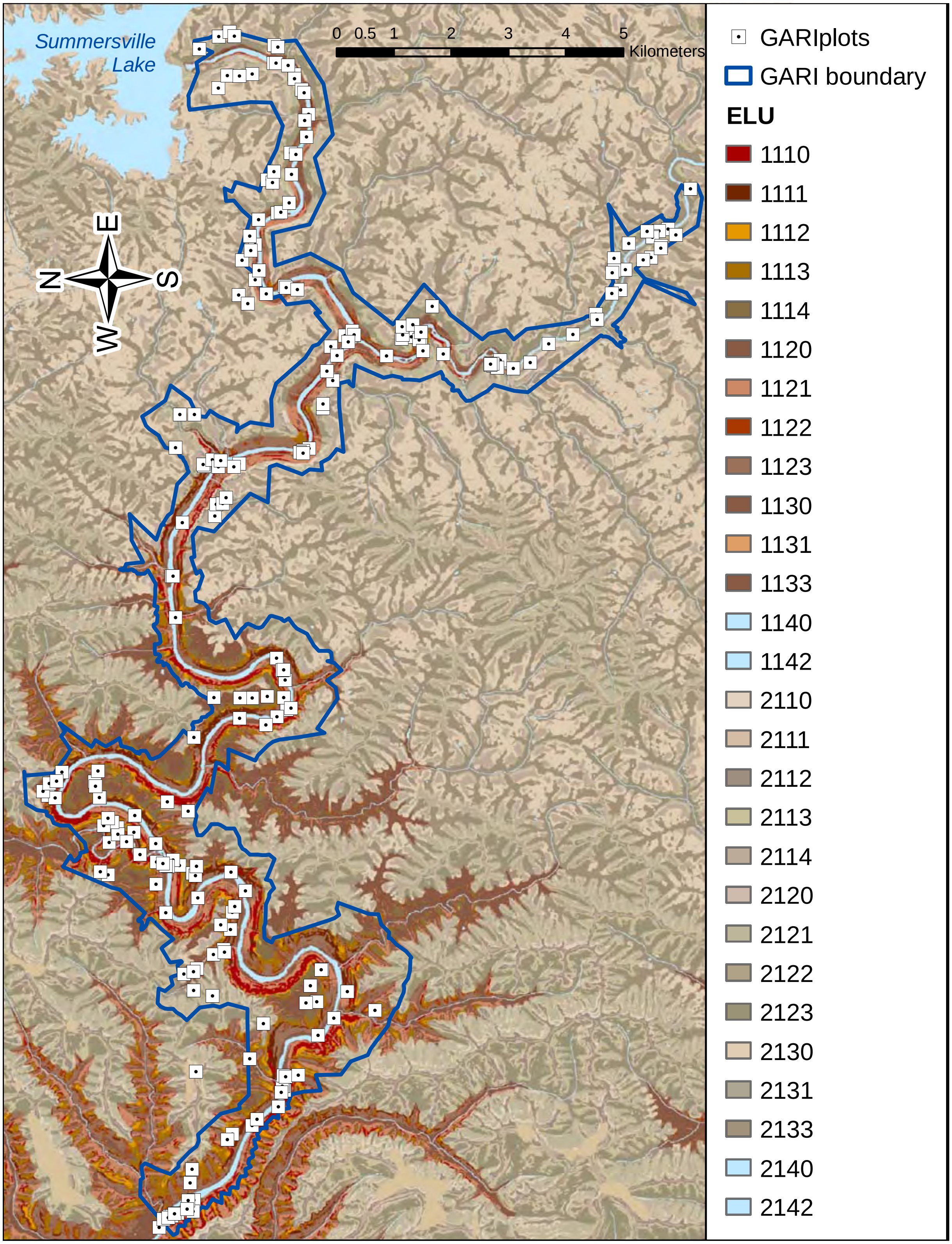

Figure 2. Ecological Land Units (ELU) and locations of plots sampled for vegetation classification and mapping of Gauley River National Recreation Area.

form for plots sampled prior to 2006 was Form 3: Quantitative Community Characterization (Sneddon 1993). In 2006–2009, the standard WVNHP Vegetation Plot Form was used. Completed examples of both of these forms are provided in Appendix A. Plots were placed in the field to sample homogenous vegetation representative of the stand (Mueller-Dombois and Ellenberg 1974) and, usually, to avoid disturbed sites and weedy areas. Plots were typically 20×20 m^2 (65×65 ft^2), but size and shape were sometimes altered to accommodate small patch and linear communities. Three types of data were collected: metadata, environmental data, and vegetation data.

Metadata included plot code, directions to the plot, representativeness, surveyors' names, sampling date, location coordinates, and associated GPS files. Locations of plots sampled in 1995 were hand mapped on USGS topographic maps. In 2000–2009 most plot locations were determined using a global positioning system (GPS). When satellite reception was possible, coordinates for plot locations were collected using Trimble GPS units and these positions were post-process differentially corrected. When satellite reception was poor, Garmin GPS units were used or the plot locations were mapped by hand on USGS topographic maps. Photographs were taken of most plots.

Environmental plot data included environmental comments, landscape comments, slope, aspect, elevation, and information on geology, landform, topographic position, hydrology, and soils. Soil information included a profile description, texture determined by hand in the field, and pH determined in the field. Soil samples were collected from plots for chemical analysis. The surface organic layer was scraped off and soil was collected from the top 10–15 cm (4–6 in) of the mineral horizon from three to five subsamples scattered around each plot. Subsamples from each plot were combined and mixed, the soil was dried and sieved, and 50-g (1.6-oz) samples were sent to Brookside Laboratories Inc. (New Knoxville, OH) for chemical analysis; tests included total exchange capacity, pH, % organic matter, estimated N release, and ppm S, P, Ca, Mg, K, Na, B, Fe, Mn, Cu, Zn, and Al (Brookside Laboratories Inc. 2008).

Vegetation plot data included information on physiognomy (structure) and species composition. Height and percent cover of each stratum (canopy, subcanopy, tall shrub, short shrub, herb, and nonvascular) were estimated. Physiognomic type (forest, woodland, shrubland, herbaceous, non-vascular, and sparsely vegetated) of the stand was determined according to the definitions provided in Appendix B (adapted from Sneddon 1993, TNC and ESRI 1994a). Diameter at breast height (dbh) was measured for all woody stems greater than 7 cm (2.75 in) dbh. All vascular plants in plots were identified and percent cover in each stratum by each taxon was determined by ocular estimation. Total cover by each taxon (combining cover in all strata but not including overlap) was also recorded. Percent cover by individual bryophytes and lichens was recorded for species having greater than 1% cover. Primary references used in the field to key out vascular plants included Flora of West Virginia (Strausbaugh and Core 1977) and Manual of Vascular Plants of Northeastern United States and Canada (Gleason and Cronquist 1991). Bryophyte collections were identified by Dr. Susan Studlar (West Virginia University) and lichen collections were identified by Don Flenniken, author of the Macrolichens in West Virginia (Flenniken 1999).

Nomenclature for vascular plants follows the Checklist and Atlas of the Vascular Flora of West Virginia (Harmon et al. 2006), except for *Dichanthelium* and *Panicum* which follow the Flora of

North America (Freckmann and Lelong 2003). Nomenclature for mosses and liverworts (Bryophyta) follows the Annotated Checklist of the Hornworts, Liverworts, and Mosses of West Virginia (Studlar et al. 2002). Nomenclature for lichens (Ascomycota) follows a Cumulative Checklist for the Lichen-forming, Lichenicolous and Allied Fungi of the Continental United States and Canada (Esslinger 2009). Nomenclature for mushrooms (Basiodmycota) follows Mushrooms of West Virginia and the Central Appalachians (Roody 2003). These references are the standards used by WVNHP for vegetation plots and represent the most complete, up-to-date, and consistent taxonomy available for West Virginia.

A collection-based floristic inventory of GARI was conducted in concurrence with plot sampling for vegetation classification. Because of this, most of the vascular plant species identified in vegetation plots were collected from the park. Many bryophytes and lichens were also collected. Specimens from this inventory are deposited in herbaria of the NPS in Glen Jean, WV, and West Virginia University in Morgantown, WV. Details on the methods and results of the floristic inventory are covered in a separate report (Streets and Vanderhorst 2010).

Data from plots were entered in the Plots database version 2.0 (NatureServe 2004), an Access application developed for the USGS / NPS Vegetation Mapping Program. Plots were assigned alphanumeric plot codes beginning with GARI, except for three plots sampled in Carnifex Ferry Battlefield State Park, which were assigned plot codes beginning with CFSP.

Multivariate analysis, utilizing PC-Ord software (McCune and Mefford 1999), was used to provide insight for classification of vegetation. This was an iterative process which involved analyses of various sets and subsets of plot data, using one-way and two-way hierarchical agglomerative cluster analysis, non-metric multidimensional scaling (NMS), and indicator species analysis. Data screening for all analyses included elimination of all nonvascular taxa, vascular taxa with uncertain identification or identified to the generic or higher taxonomic level, and taxa which occurred in only one plot. Outlier plots were identified and removed from analyses because they can have large effects on outcomes and conclusions (McCune and Grace 2002). Several data transformations were tried but most analyses performed best with cover values square-root transformed. Cluster analysis was performed on the entire data set and on various subgroups. Additional cluster analyses included plot data from outside the study area (WVNHP 2010) to provide a broader context for making classification decisions. Cluster analysis was run using the Sorenson distance measure and Flexible Beta group linkage method with Beta set to -0.25. Indicator species analysis (Dufrêne and Legendre 1997) was used to identify the species which help define the groups. NMS was run on smaller subgroups, either defined by the cluster analysis or by physiognomy (e.g. deciduous forest, herbaceous) or hydrology (e.g. upland, riparian). NMS was run using the Sorenson distance measure and the auto-pilot mode in PC-Ord set to “slow and thorough” (McCune and Mefford 1999).

An NMS ordination was also run on soil chemistry data from plots. Values for chemical variables (total exchange capacity, pH, % organic matter, estimated N release, and ppm S, P, Ca, Mg, K, Na, B, Fe, Mn, Cu, Zn, and Al) were relativized by their column totals (McCune and Grace 2002). NMS was run using the Sorenson distance measure and the auto-pilot mode in PC-Ord set to “slow and thorough” (McCune and Mefford 1999).

The final vegetation classification for the park also incorporates information gained from plot environmental data, classified plot data from other WV sites (Byers et al. 2007, Vanderhorst 2000, 2001a, 2001b, 2002a, 2002b; Vanderhorst and Streets 2006; Vanderhorst et al. 2007; Vanderhorst et al. 2008; WVNHP 2010), and aerial imagery interpretation, and has been molded by a need for conformity with the USNVC. Because of this, and the realization that plot sampling is always an imperfect representation of the total range of variability in complex systems, the classification does not conform to the results of any one multivariate analysis.

After the final classified GARI community types (putative associations) were decided upon, individual plots were attributed to each community type. One plot was not assigned to a community type because it represented an ectotone. Indicator species analysis (Dufrêne and Legendre 1997) was run on various subgroupings to identify plant species most useful for distinguishing types in the field. Floristic constancy/cover tables and plot floristic synthesis tables were developed for each community type using Access queries and Excel pivot tables. Similar summary tables were produced for environmental variables using Access queries and GIS analyses. A dichotomous key was developed to facilitate identification of GARI community types in the field based on floristic and environmental variables, and this was provided to NCSU to serve as the basis for assessing thematic accuracy of the completed vegetation map.

The vegetation classification for the park was crosswalked to the USNVC in consultation with NatureServe ecologists. Data from each GARI community type were compared to existing associations in the USNVC and decisions were made either to place the local types in existing associations or to develop new associations.

Data from the floristic and environmental tables were used to write local association descriptions and new global USNVC association descriptions, and to edit existing global USNVC association descriptions to accommodate GARI vegetation. Local and global descriptions were entered in Biotics, the central database for biodiversity information maintained by NatureServe.

Aerial Photography Acquisition and Processing

Sanborn Mapping Company, Inc. acquired color infrared, stereo pair, 1:12,000 scale aerial photography for a digital orthophoto mosaic of GARI on March 27, 2003, during leaf-off conditions. The aerial photographs were delivered to the NPS, quality checked, accepted as provided, and sent to NCSU. Upon receipt at NCSU, the aerial photographs were counted to make sure that none were missing, scanned and saved in TIFF format, and placed in the data archive that NCSU maintains for the NPS Northeast Region Inventory & Monitoring Program. Associated data and information provided by Sanborn Mapping Company, Inc. that are also stored in the data archive include the airborne global positioning system (GPS) and inertial mapping unit (IMU) data files, the camera calibration certificate, and a digital flight index map.

The mosaic was produced from 98 color infrared aerial photographs, scanned at 600 dpi with 24-bit color depth. Scanned TIFF images of the aerial photographs were imported into ERDAS IMAGINE IMG format where a photo block was created using the airborne GPS and IMU data that Sanborn Mapping Company, Inc. supplied with the aerial photographs. The photo block was manipulated until it could be triangulated with a root mean square error of less than 1. At this point, single frame orthophotos (one for each aerial photograph) were generated within

IMAGINE and exported to IMAGINE LAN format. Then the LAN files were imported into ER Mapper's native (ERS) format, and an ER Mapper algorithm was created which contained the color balancing information and the cutlines for the final mosaic. Band interleaved by line (BIL) image and header files for the mosaic were generated in ER Mapper, the BIL image was imported into IMAGINE IMG format, and, finally, the IMG image was compressed using MrSID software with a 20:1 compression ratio. The final mosaic, in both IMG and MrSID formats, is stored in the NCSU data archive.

A metadata record for the mosaic was prepared in accordance with the current FGDC standards (FGDC 1998a). Metadata were produced in notepad and parsed using the USGS metadata compiler (USGS 2004). After all errors and omissions identified by the parser were corrected, the metadata compiler was used to generate final TXT, HTML, and XML versions of the metadata record which are stored in the data archive. Key information for the mosaic is summarized in Table 2.

Vegetation Mapping

A vegetation map for GARI was developed as a personal geodatabase using ESRI ArcGIS software. The geodatabase includes a point feature class for locations of plots, and two polygon feature classes (clipped by the park boundary and unclipped) for vegetation and non-vegetated land cover.

The plots point feature class (Figure 2) was produced from locational coordinates collected using GPS units (Trimble Explorer3 and GeoExplorerXT) or from coordinates mapped by hand on topographic maps. Trimble GPS units were used to collect coordinates of plot locations whenever satellite reception was available. GPS data from Trimble units were post-process differentially corrected and exported as attributed GIS files using Trimble Pathfinder Office software. Locations determined by the Garmin unit were used for 12 plots when reception using a Trimble unit was poor. Locations of the 30 plots sampled in 1995, prior to broad-scale use of GPS technology, were hand mapped on USGS topographic maps. Locations of 27 plots sampled in 2006–2009 were also hand mapped because GPS reception was not possible with any unit due to poor satellite reception (most common on north slopes and in deep, narrow canyons). All plot points were combined in one feature class which includes attribute information on GPS methods, estimated accuracy for each point, survey metadata, and GARI community type and USNVC association names for each plot determined by the vegetation classification.

Transparencies of leaf-on color infrared aerial photography flown in October 2003 (Vanderhorst et al. 2007) and the original transparencies used to produce the orthophoto mosaic for this project were examined on a light table to help distinguish signatures which were not apparent on the digital imagery. Utilization of these multiple sets of aerial photography often helped to overcome deficiencies (e.g. shading) of the primary orthophoto mosaic. Ancillary GIS layers used to assist photointerpretation included digital raster graphs of USGS topographic maps and the landform and ELU models developed for this project.

Table 2. Summary of key information for the Gauley River National Recreation Area (GARI) mosaic.

Title of metadata record:	Gauley River National Recreation Area Color Infrared Orthorectified Photomosaic - Leaf-off (ERDAS IMAGINE .img and MrSID formats)
Publication date of mosaic (from metadata):	15-Sep-2005
Date aerial photographs were acquired:	27-Mar-2003
Vendor that provided aerial photographs:	Sanborn Mapping Company, Inc.
Scale of aerial photographs:	1:12,000
Type of aerial photographs:	Color infrared, stereo pairs
Number of aerial photographs delivered:	98
Archive location of aerial photographs, airborne GPS and IMU data, flight report, camera calibration certificate, and digital flight index map:	North Carolina State University, Center for Earth Observation
Scanning specifications:	600 dpi, 24-bit color depth
Horizontal positional accuracy of mosaic:	1.31 meters, meets Class 1 National Map Accuracy Standard (Calculated for BLUE, Gauley River National Recreation Area (GARI) and New River Gorge National River (NERI) together)
Number of ground control points upon which estimated accuracy is based:	147 (for BLUE, GARI, and NERI together)
Method of calculating positional accuracy:	Root mean square error
Archive location of mosaic and metadata:	North Carolina State University, Center for Earth Observation
Formats of archived mosaic:	IMG (uncompressed) and MrSID (20:1 compression)

Aerial imagery interpretation was initiated by examining signatures throughout the park in relation to GIS-mapped plot locations. Selection of map classes was driven by the imagery. When individual associations could be reliably mapped, these were chosen as map classes. Complex map classes were used when individual associations could not be distinguished due to tight zonation or patchiness. Map classes were also developed for aquatic, cultural, and disturbed areas and features. The stated minimum mapping unit for this project was 0.5 ha (1.23 ac), but smaller polygons were often delineated for small patch or linear types with distinct signatures. Small creeks were mapped to the extent that their courses were visible on photography, with only short gaps estimated. Polygons were drawn using the ArcGIS editing tools with the screen set at various scales, commonly 1:3,000, depending on the vegetation patch size and distinctiveness of boundaries. Polygons were attributed with the name of the map class and, sometimes, comments related to the vegetation or its photo signature. After a relatively complete list of map classes was established, an attribute domain (a constrained picklist of values) was created to limit map class names to this list. The domain was altered as a few additional map classes were identified. Topology was established to enforce rules for no gaps or overlaps. All areas within the park boundary were mapped and mapping was usually extended somewhat beyond the boundary to insure complete coverage.

A field was included in the vegetation map attribute table to indicate which United States Fish and Wildlife Service (USFWS) wetland system (Cowardin et al. 1979) a map class represents. Polygons representing USNVC associations which are classified as wetland formations (i.e. those with hydrologic modifiers of “temporarily flooded” in the formation name) were attributed “palustrine.” Polygons of the Riparian Zone map class, which is comprised of multiple USNVC associations, were also attributed as palustrine. Polygons representing USNVC associations that are not classified as wetland formations were attributed as “upland.” Wetland status of individual polygons of the Developed Area, Disturbed Area, and Utility Corridor map classes, which do not represent USNVC associations, were attributed as palustrine or upland depending on landscape position, adjacent map classes, plot data, and air photo signature. All polygons of the Road map class were attributed as upland, although some sections may cross wetlands. Polygons of the River and Creek map classes were attributed as “open water.” These attributions are not intended to represent a rigorous delineation of jurisdictional wetland status, but they do identify polygons where jurisdictional wetlands are most likely to occur. The actual area of jurisdictional wetlands contained in a polygon attributed palustrine is likely to be less than the actual area of the polygon due to inclusions of uplands in the floodplain map classes; whereas, polygons attributed upland may actually contain jurisdictional wetlands due to small wetland inclusions in the upland map classes.

A draft vegetation map was provided to NCSU Center for Earth Observation on June 29, 2009 for accuracy asserssment. A few changes were made to the draft vegetation map after results of thematic accuracy assessment were received. Aerial photo signatures of all misclassified accuracy assessment points were reviewed and polygons in the vegetation feature class were edited when appropriate. Most edits involved splitting polygons and reattributing the parts of the original polygon according to the correct classification determined by the accuracy assessment point. In a few cases the entire original polygon was reattributed or comments were added to indicate gradation or inclusions within the polygon. Comments were added to all edited polygons to indicate they were edited post accuracy assessment. In addition, three polygons were added after spatial review by the NPS identified small gaps between the draft vegetation map and the

park boundary GIS layers. Post accuracy assessment editing affected 32 of the total 2,104 polygons in the final vegetation map. The final vegetation polygon feature class was clipped by the NPS park boundary layer and aerial statistics were calculated to summarize the relative abundance of each map class within the park.

Metadata records for each feature class in the vegetation map geodatabase were prepared in accordance with the current FGDC standards (FGDC 1998a). Metadata records were edited with ESRI ArcGIS, the NPS Metadata Tools and Editor, and Microsoft Notepad, and were parsed using the USGS metadata compiler (USGS 2004). All errors and omissions identified by the parser were corrected. Metadata records are included within the final geodatabase for the vegetation map.

Accuracy Assessment

Positional Accuracy Assessment

For purposes of accuracy assessment, mosaics of Bluestone National Scenic River (BLUE), Gauley River National Recreation Area, and New River Gorge National River (NERI) were treated as a single entity because the photography was acquired in a single flight with the same camera and with one set of airborne GPS and IMU data. Horizontal positional accuracy of the mosaics was assessed using guidelines of the USGS/NPS Vegetation Mapping Program (ESRI et al. 1994). Well-defined positional accuracy ground control points were placed throughout all quadrants of each mosaic in ESRI ArcView 3.3. Ground control points and zoomed-in screenshots of each point were plotted on hard copy maps with the mosaic as a background. These maps and plots were used to locate the ground control points in the field. Field staff recorded the ground control point coordinates with a Trimble Pro XRS. Mapped ground control points that were physically inaccessible were also noted. The field crew collected accuracy assessment data at 160 ground control points. The coordinate data were collected with real-time GPS and post processed with differential correction using Pathfinder Office software. Prior to calculating accuracy, 13 ground control points were identified as outliers with SAS's JMP program and removed. The field-collected GPS coordinates for the remaining 147 points were compared to the coordinates obtained from each mosaic viewed in ESRI ArcView 3.3. Both pairs of coordinates for each point were entered into a spreadsheet in order to calculate horizontal accuracy (in meters). The accuracy calculation formula is based on root mean square error (FGDC 1998b; Minnesota Governor's Council on Geographic Information and Minnesota Land Management Information Center 1999). Figure 3 shows the distribution of the ground control points within the three parks and surrounding area.

Thematic Accuracy Assessment

The thematic accuracy of the draft vegetation map dated June 29, 2009 was assessed by the NCSU Center for Earth Observation using the vegetation key dated June 29, 2009. The vegetation map consisted of 2,086 polygons representing 31 map classes (24 vegetation classes and seven other land cover classes) covering a total area of 4,794 ha (11,846 ac). In developing the accuracy assessment sampling plan, NPS personnel and NCSU staff determined that cost and time constraints limited the target number of data collection points to 150. In order to obtain

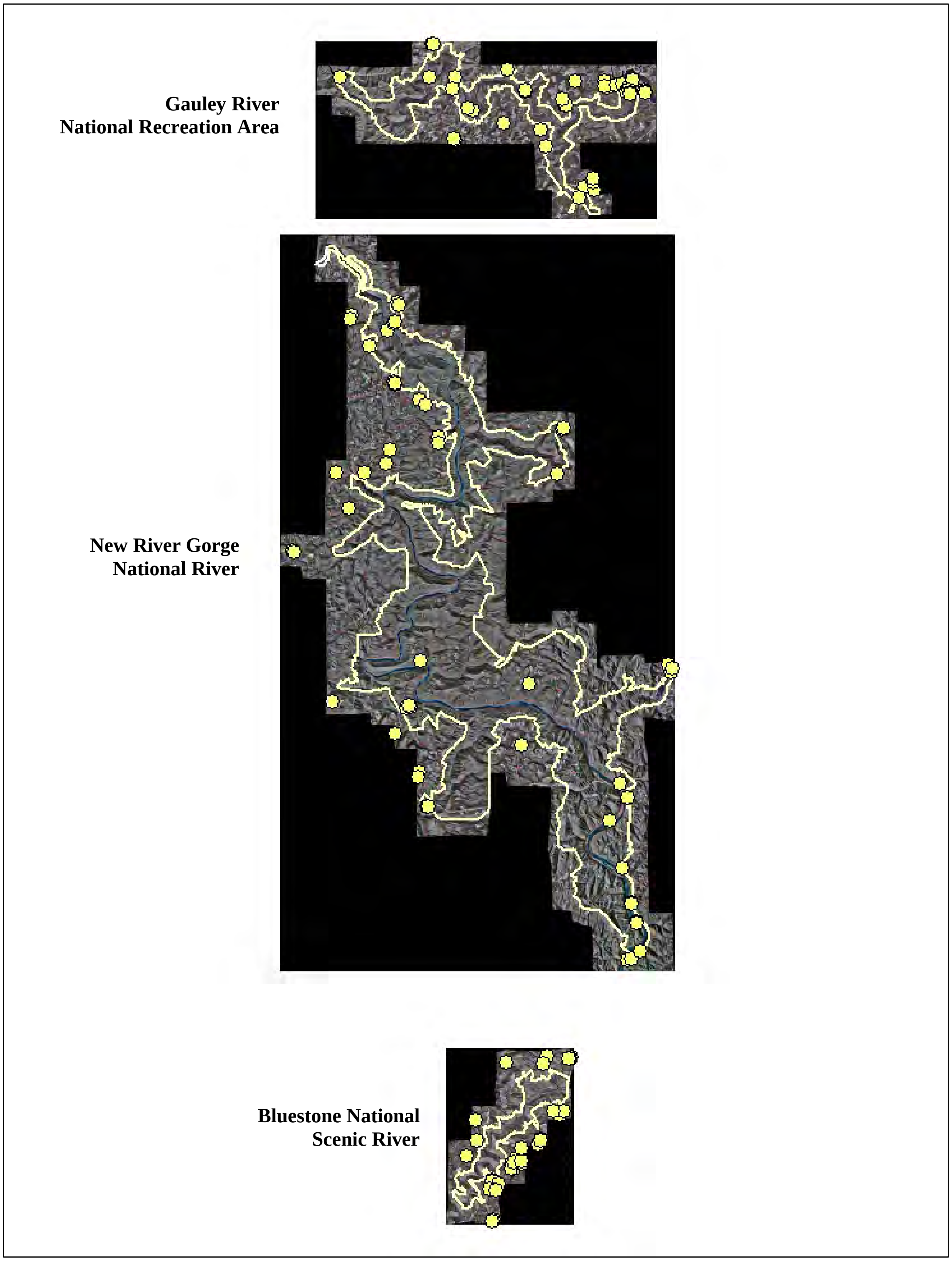

Figure 3. Ground control points used to calculate horizontal positional accuracy of the Gauley River National Recreation Area, New River Gorge National River, and Bluestone National Scenic River leaf-off mosaics.

field data from approximately 150 points, a point-based, stratified random sample (where strata are vegetation classes) of 302 points was selected from areas in polygons that represent vegetated land cover. The whole of the area representing vegetated land cover was considered available for sampling, regardless of ownership status. The sampling frame excluded seven map classes that represent non-vegetated land cover: Backchannel, Creek, Developed Area, Pond, Railroad, Road, and River.

The sample of 302 points was allocated to vegetation map classes according to class abundance and frequency as specified by USGS Accuracy Assessment (AA) Procedures (ESRI et al. 1994), as follows:

1. For map classes with fewer than five polygons that occupy less than 50 ha (123.5 ac) in total area, one sampling point was selected in each polygon, unless the polygon contained a vegetation sampling plot, in which case the polygon was not sampled.

2. For map classes with 5–29 polygons that occupy less than 50 ha (123.5 ac) in total area, nine sampling points per map class were selected with the expectation that data would be collected from at least five sampling points per map class.

3. For map classes with fewer than 30 polygons that occupy more than 50 ha (123.5 ac) in total area, 12 sampling points per map class were selected with the expectation that data would be collected from at least six sampling points per map class.

4. For map classes with 30 or more polygons that occupy more than 50 ha (123.5 ac) in total area, 18 sampling points per map class were selected with the expectation that data would be collected from at least nine sampling points per map class.

The sample of 302 accuracy assessment points was selected using the Create Random Selection tool in Hawth's Tools in ArcGIS (Beyer 2004; ESRI 2005). A few sample points fell outside the park boundary, but all points were within the geographic extent of the vegetation map.

In addition, the following criteria and decision rules were used for selecting sample points:

1. The USGS AA Procedures indicate that map classes with fewer than five polygons occupying less than 50 ha (123.5 ac) in total should be observed in their entirety. Therefore, each of these classes was allocated one sample point per polygon.

2. No sample points were selected within 30 m of a vegetation sampling plot. In cases where a vegetation sampling plot was located in a polygon of a map class with fewer than five polygons occupying less than 50 ha (123.5 ac) in total, that polygon was not sampled. As a result the Burreed Marsh map class was not sampled because it has only one polygon and that polygon contains a vegetation sampling plot.

3. The number of points recommended by the USGS AA Procedures exceeded the target sample size of 150 points. To reconcile this difference, the number of points sampled in the three most abundant classes was reduced proportionally after sampling points were allocated to the less abundant classes as described in Items 1 and 2 above.

4. To the extent possible, potentially inaccessible sample points were identified and replaced prior to field visit. Sample points that were found to be impractical to access during the field visit were dropped and, if possible, an alternative site within the same map polygon was located in the field.

5. In order to avoid transition zones (ecotones,) no points were selected within 30 m (98 ft) of a polygon boundary. Where the polygon was too narrow for this rule to be followed, the points were moved to locations equidistant from the polygon boundaries. Examples of these types of vegetation include Forest Seep and Cliff Face. Fortunately, most of these vegetation cover class polygons had fairly discrete boundaries and there was little problem identifying them in the field.

6. All sample points were required to be at least 60 m (197 ft) away from the nearest neighboring sample point.

An ArcGIS shapefile containing the 302 sample points was created and the attribute table was edited to include fields needed to record the data to be collected at each point. The shapefile was imported into Trimble .ssf format and loaded into a Trimble GeoXP global positioning system (GPS) unit. This allowed the field ecologist to enter data directly into an electronic file in real time, eliminating the need for paper forms.

In September 2009, the ecologist collected field data at a total of 147 accuracy assessment points (Table 3, Figure 4). These 147 points were chosen from the random sample of 302 potential points based on accessibility, efficiency, and abundance. For example, a reasonably accessible point from a class with a small number of potential points that was within hiking distance of additional points was more likely to be visited than an isolated point of tenuous accessibility from a class with many alternate points.

In the field, the ecologist navigated as close as possible to sample points using the Trimble GPS unit. The field observations were entered and the new GPS coordinates were stored. The GPS unit had the datum set to North American 1983 (Conus) and the coordinate system set to UTM zone 17. The GPS data for all AA points were differentially corrected. The planimetric (X, Y) accuracy is ±5 m (16 ft) for 136 of the 147 points and ±10 m (32 ft) for 11 points.

The vegetation or land cover at each accuracy assessment point was identified and classified based on the dichotomous vegetation key developed for the vegetation mapping project. The map classes Cliff Face and Riparian Zone include multiple vegetation associations. For accuracy assessment points in these two map classes, both the vegetation map class and the vegetation association, as determined from the key, were noted. Data collected for each sample point are described in Appendix C and include all items recommended in the USGS AA Procedures. Digital photographs were taken at 143 sample points. Data from the 147 accuracy assessment points were entered into the NatureServe PLOTS 2.0 Database System on a Microsoft Access platform. In the PLOTS database, species were assigned standardized codes based on the PLANTS Database (USDA, NRCS 2009).

Table 3. Thematic accuracy assessment (AA) sampling strategy for the Gauley River National Recreation Area draft June 29, 2009 vegetation map.

Map Class	Number of Polygons	Area Mapped (Hectares)	Minimum Number of AA Points Recommended by Protocol	Number of AA Points Visited
Yellow Birch Cold Cove Forest	3	4.79	3	3
American Water-willow Cobble Bar	3	0.57	3	2
Oak - Hickory Floodplain Forest	6	3.06	5	7
Forest Seep	8	1.25	5	4
Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest	8	3.71	5	6
Utility Corridor	10	5.04	5	5
American Sycamore - Tuliptree - Sweetgum Floodplain Forest	11	5.71	5	7
(Virginia, Pitch) Pine Floodplain Forest	13	5.10	5	8
American Sycamore - River Birch Riverscour Woodland	13	3.54	5	5
Cliff Face	81	9.39	20	6
Cliff Top Virginia Pine Forest	60	17.18	20	4
Eastern Hemlock Floodplain Forest	78	21.26	20	6
Riparian Zone	281	63.82	30	10
Oak / Ericad Forest	47	57.28	30	10
Successional (Virginia, Pitch) Pine Forest	43	96.66	30	12
Disturbed Area	151	134.81	30	10
Successional Tuliptree Forest	113	178.08	30	10
Oak / Great Laurel Forest	121	192.44	30	8
Eastern Hemlock Plateau Forest	95	266.60	30	6
Oak - Hickory - Sugar Maple Forest	167	380.14	30	6
Oak - Hickory Forest	162	438.25	30	3
Sugar Maple - Yellow Buckeye - American Basswood Forest	151	456.05	30	4
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest	254	2,018.87	30	5
Total	1,879	4,363.57	431	147

[a]Map class represents map class as selected from the map, not map class as observed at the site.

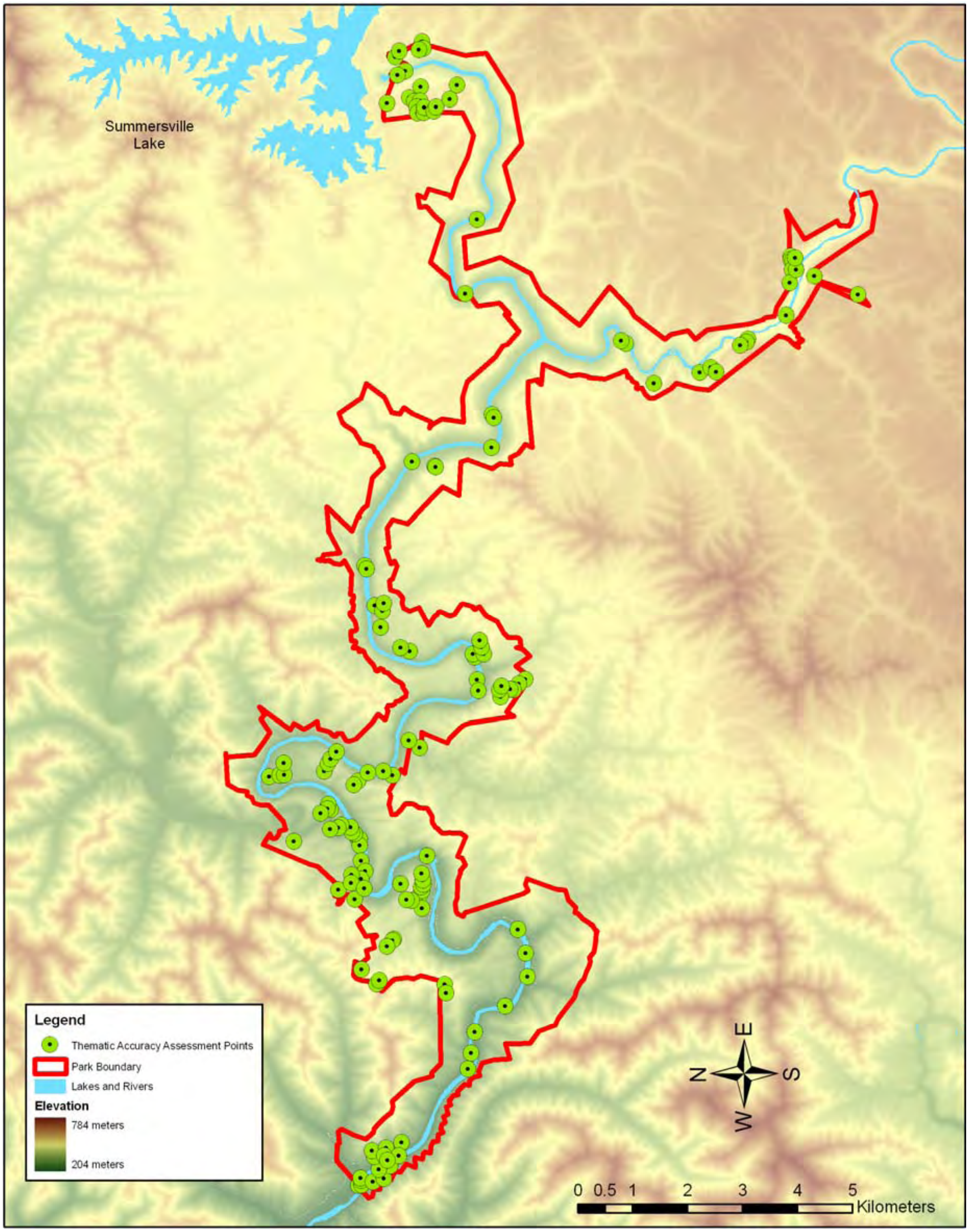

Figure 4. Locations of thematic accuracy assessment data collection points in Gauley River National Recreation Area.

Thematic accuracy of the vegetation map was tabulated using a contingency matrix that compared the mapped vegetation associations with the actual vegetation associations observed in the field. Overall percent accuracy and the Kappa index were calculated (ESRI et al. 1994). Overall percent accuracy was calculated by dividing the number of correctly classified accuracy assessment points by the total number of accuracy assessment points. The Kappa index (*K*)

$$K = \frac{\textit{observed accuracy} - \textit{chance agreement}}{1 - \textit{chance agreement}}$$

is the preferred method of reporting overall thematic accuracy because it takes into account that a certain number of correct classifications will occur by chance (Foody 1992). USGS AA Procedures specify that the Kappa index of vegetation maps should exceed 80% (ERSI et al. 1994).

Producer's accuracy and user's accuracy were also calculated in the contingency matrix. The producer's and user's accuracies for each vegetation map class should exceed 80% according to USGS AA Procedures (ESRI et al. 1994). These statistics are not independent, such that one incorrect observation point influences both the producer's and the user's accuracy.

Producer's accuracy represents the percentage of a given map class that is correctly identified on the map. In other words, from the perspective of the map, what are the chances that this mapped map class correctly matches the vegetation on the ground? Producer's accuracy is calculated by dividing by the number of correct observation points in one map class by the total number of observation points in that map class. Error of omission is calculated as 1 - producer's accuracy. This error indicates the percentage of observation points that should have been mapped in a given class, but were omitted.

User's accuracy represents the probability that a given location on the ground is classified correctly on the map. In other words, from the perspective of the real world vegetation, what are the chances the vegetation observed on the ground correctly matches the map class? User's accuracy is calculated by dividing the number of correctly classified points for a map class by the total number of points that the field observer identified as being of that map class. Error of commission is calculated as 1 - user's accuracy. This error indicates the probability that a mapped vegetation or land cover type actually represents the vegetation or land cover on the ground.

Results

Vegetation Classification

Twenty-four vegetation community types of the park are classified in 23 associations of the USNVC, including 14 upland associations and nine riparian and wetland associations (Table 4). Two GARI upland community types, Eastern Hemlock Plateau Forest and Successional Pitch Pine Forest, are classified as variants of the same USNVC association. Prevailing physiognomic expressions include 17 forest associations, one woodland association, three herbaceous associations, one non-vascular association, and one sparse vegetation association. Two riparian associations new to the USNVC, Riverscour Shrub Prairie and (Virginia, Pitch) Pine Floodplain Forest, are recognized and described here for the first time based on data from plots at GARI and additional plots along other rivers in West Virginia.

Twenty-one USNVC associations represent natural vegetation types in the park and two associations are semi-natural successional vegetation types that have developed on land previously cleared for agriculture or excavated for dam construction. Successional status in the park is indicated in the GARI community type name. The GARI community type Successional Pitch Pine Forest is classified as a successional variant of the USNVC association for Eastern Hemlock Plateau Forest, a natural community type, because there is no existing USNVC association for successional stands dominated by pitch pine (*Pinus rigida*). The global conservation rank (Table 4) for two of the successional types is GNA (not applicable), indicating that the associations are not considered priority targets for conservation of biological diversity, although they may provide important habitat for some native species and may eventually succeed towards natural vegetation types. Global ranks assigned for 16 associations range from G2G3 (imperiled or vulnerable) to G5 (secure). Six associations have not yet been assigned global conservation ranks (GNR). State conservation ranks have not been assigned for any of the associations. State and global conservation status rank definitions are provided in Appendix D.

A list of vascular and non-vascular plant, fungi, and lichen taxa identified from plots and accuracy assessment points is provided in Appendix E. The list is alphabetically sorted by scientific name and includes common name, family, and division. Seven hundred eighty-two taxa are listed, representing 663 species; the additional 119 taxa represent multiple subspecific taxa per species and identifications made to higher taxonomic ranks. One hundred fifty-two families are represented in nine divisions, including 90 families in the Magnoliophyta (flowering plants), two families in the Pinophyta (conifers), eight families in the Polypodiophyta (ferns), two families in the Lycopodiophyta (club mosses, spike mosses, quillworts), one family in the Equisetophyta (horsetails), 23 families in the Bryophyta (mosses), ten families in the Marchantiophyta (liverworts), 12 families in the Ascomycota (cup fungi, including lichens), and four families in the Basidiomycota (club fungi). Five hundred fifty-four species of vascular plants (Magnoliophyta, Pinophyta, Polypodiophyta, Lycopodiophyta, and Equisetophyta) were identified, including 37 species that are nonnative to North America. Detailed results of a vascular plant floristic inventory, which was conducted concurrently with vegetation mapping for GARI, are provided in a separate report (Streets and Vanderhorst 2010).

Table 4. Vegetation community types occurring in Gauley River National Recreation Area (GARI), the corresponding U.S. National Vegetation Classification (USNVC) association names, and their global conservation ranks.

GARI Community Type Name	**USNVC Association Name**	**USNVC Association Code**	**Global Conservation Rank**
Upland communities			
Cliff Top Virginia Pine Forest	*Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum* Forest	CEGL007119	G4?
Common Rock Tripe Cliff Face	*Umbilicaria mammulata* Nonvascular Vegetation	CEGL004387	G4?
Dry Cliff Face	Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation	CEGL006435	GNR
Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest	*Quercus prinus / Rhododendron catawbiense - Kalmia latifolia* Forest	CEGL008524	G3?
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest	*Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest	CEGL007543	G5
Eastern Hemlock Plateau Forest	*Liriodendron tulipifera - Pinus strobus - Tsuga canadensis - Quercus (rubra, alba) / Polystichum acrostichoides* Forest	CEGL006304	G4?
Oak / Ericad Forest	*Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest	CEGL006271	G5
Oak / Great Laurel Forest	*Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest	CEGL006286	G4
Oak - Hickory Forest	*Quercus prinus - (Quercus rubra) - Carya spp. / Oxydendrum arboreum - Cornus florida* Forest	CEGL007267	G4G5
Oak - Hickory - Sugar Maple Forest	*Quercus prinus - Carya ovata - Quercus rubra / Acer saccharum* Forest	CEGL007268	G4?
Successional Pitch Pine Forest	*Liriodendron tulipifera - Pinus strobus - Tsuga canadensis - Quercus (rubra, alba) / Polystichum acrostichoides* Forest	CEGL006304	G4?
Successional Tuliptree Forest	*Liriodendron tulipifera - Quercus* spp. Forest	CEGL007221	GNA
Successional Virginia Pine Forest	*Pinus virginiana* Successional Forest	CEGL002591	GNA
Sugar Maple - Yellow Buckeye - American Basswood Forest	*Liriodendron tulipifera - Tilia americana* var. *heterophylla - Aesculus flava - Acer saccharum / (Magnolia tripetala)* Forest	CEGL005222	G4?
Yellow Birch Cold Cove Forest	*Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / (Leucothoe fontanesiana)* Forest	CEGL007861	G2G3
Riparian and wetland communities			
American Sycamore - River Birch Riverscour Woodland	*Platanus occidentalis - Betula nigra / Cornus amomum / (Andropogon gerardii, Chasmanthium latifolium)* Woodland	CEGL003725	GNR
American Sycamore - Tuliptree - Sweetgum Floodplain Forest	*Liquidambar styraciflua - Liriodendron tulipifera / Lindera benzoin / Arisaema triphyllum* Forest	CEGL004418	G4
American Water-willow Cobble Bar	*Justicia americana* Herbaceous Vegetation	CEGL004286	G4G5

GARI Community Type Name	USNVC Association Name	USNVC Association Code	Global Conservation Rank
Riparian and wetland communities (continued)			
Bur-reed Marsh	*Sparganium americanum - (Sparganium erectum* ssp. *stoloniferum) - Epilobium leptophyllum* Herbaceous Vegetation	CEGL004510	G2G3
Eastern Hemlock Floodplain Forest	*Tsuga canadensis - Quercus rubra - (Platanus occidentalis, Betula nigra) / Rhododendron maximum / Anemone quinquefolia* Forest	CEGL006620	GNR
Forest Seep	*Acer rubrum - Nyssa sylvatica / Ilex verticillata - Vaccinium fuscatum / Osmunda cinnamomea* Forest	CEGL007853	G3G4
Oak - Hickory Floodplain Forest	*Quercus (rubra, velutina, alba) / Carpinus caroliniana - (Halesia tetraptera) / Maianthemum racemosum* Forest	CEGL006462	GNR
Riverscour Shrub Prairie	*(Betula nigra - Ilex verticillata) / Andropogon gerardii - Solidago simplex* var. *racemosa* Shrub Herbaceous Vegetation	CEGL006623	GNR
(Virginia, Pitch) Pine Floodplain Forest	*Pinus virginiana - (Pinus rigida) - Nyssa sylvatica / Xanthorhiza simplicissima/ Euphorbia corollata* Forest	CEGL006624	GNR

Examples of graphic results of cluster analyses and NMS ordinations of plot floristic data are provided in Appendix F. These analyses represent mid-level iterations with the plot data set divided into two subsets, upland forests and riparian and wetland communities. Seven plots representing cliff face communities were not included in these analyses because they behave as extreme outliers. The final classification of plots is indicated by symbology overlain on the graphics. One upland forest plot was not assigned to a community type because it represents an ectotone. These graphics illustrate the relationships between the associations by grouping plots with most similar floristic composition closest to each other. Discrepancies between the placements of individual plots by multivariate techniques in comparison to the final classification are apparent, but the overall patterns of the classification are supported by these quantitative analyses.

An NMS ordination graph of plot soil chemistry data, also provided in Appendix F, shows a strong correspondence between the vegetation classification and soil fertility gradients. Riparian communities group in the bottom of the graph in soil chemistry space representing higher pH, higher Cu, and lower levels of most other nutrients, while upland communities group in the bottom of the graph in soil chemistry space representing lower pH, higher total exchange capacity and organic matter, and higher levels of most nutrients. In the upper (upland) part of the graph there is an increasing base cation gradient from right (high Fe) to left (high Ca, Mg, Mn, P, Zn) which also corresponds to the turnover in plant species composition represented by the vegetation classification. Summary statistics (mean and standard deviation) of soil nutrients in plots grouped by community type are provided in Appendix G. Mean values for most soil nutrients across all associations at GARI are near or below the means from 1,186 vegetation plots in various habitats across West Virginia (WVNHP 2010). Most notably, GARI soils have lower mean Ca, S, and P, and higher mean Al and Mn compared to statewide means.

Tables of plot floristic summary statistics for each community type that was sampled are provided in Appendix H. Association tables are arranged alphabetically by the GARI community type name listed in Table 4. Plant taxa in the tables are sorted in descending order by constancy in plots, then in descending order by mean cover, then in ascending alphabetical order. These tables provide a quick, quantitative summary of the plant species composition of each association.

A dichotomous key to vegetation associations is provided in Appendix I. This key can be used to identify the associations in the field and to increase understanding of the distinctions between closely related types.

Detailed global and local association descriptions are provided in Appendix J. These are arranged within the hierarchical structure of the USNVC (Anderson et al. 1998); however, the hierarchy is not indicated in the table of contents for Appendix J. Vegetation classified in the park is grouped within twelve formations, arranged in the following order: 1) rounded-crowned temperate or subpolar needle-leaved evergreen forest (two associations), 2) temporarily flooded temperate or subpolar needle-leaved evergreen forest (two associations), 3) lowland or submontane cold-deciduous forest (seven associations), 4) temporarily flooded cold-deciduous forest (two associations), 5) saturated cold-deciduous forest (one association), 6) mixed needle-leaved evergreen - cold-deciduous forest (three associations), 7) temporarily flooded cold-deciduous woodland (one association), 8) temporarily flooded temperate or subpolar grassland

(one association), 9) seasonally flooded temperate or subpolar grassland (one association), 10) temporarily flooded temperate perennial forb vegetation (one association), 11) alpine to submontane temperate or subpolar lichen vegetation (one association), and 12) cliffs with sparse vascular vegetation (one association). Local information provided for each association includes a photograph of a representative stand, environmental and vegetation descriptions, geographic range within the park, classification comments, and a list of plots which represent the type. Global information includes the classification hierarchy, range-wide environmental and vegetation descriptions, range-wide geographic distribution, global conservation status, classification information, and references. Appendix K is the bibliography for the global descriptions.

Accuracy Assessment

Positional Accuracy of Mosaics

The horizontal positional accuracy of the three mosaics (BLUE, GARI, NERI) together is 1.31 meters, which meets the Class 1 National Map Accuracy Standard (FGDC 1998b). A copy of the spreadsheet containing the x and y coordinates for each ground control point and the accuracy calculation formula is included in the data archive.

Thematic Accuracy

The thematic accuracy of the draft June 29, 2009 vegetation map was calculated with a contingency matrix (Table 5). The Kappa index for the vegetation map is 87.1% ± 4.89% and the overall percent accuracy is estimated to be 87.8%. Both estimates meet the USGS AA Procedures requirement of 80%. User's Accuracy (error of commission) is 100% for 16 of the 23 map classes analyzed and ranges from 33% to 92% for the remaining seven map classes, while Producer's accuracy (errors of omission) is 100% for 13 map classes and ranges from 40% to 86% for the remaining 10 map classes. Only two of the 23 map classes had a User's accuracy under 50% (Oak - Hickory Forest and Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest), while only one map class had a Producer's accuracy under 50% (Successional Tuliptree Forest). The high errors of commission and omission for these three classes indicate that they were not consistently distinguished by aerial photography interpretation. In addition, however, it should be noted that small sample sizes may have contributed to the low accuracies. For example, the recommended number of accuracy assessment sample points for Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest was 30, but only five sample points were visited. Had sample sizes been larger, it seems likely that the User's accuracies would have been higher.

Table 5. Contingency matrix and calculated errors for the thematic accuracy assessment of the Gauley River National Recreation Area draft June 29, 2009 vegetation map.

			MAPPED																							Total	User's Accuracy, (% correct)
	Map Class		**cf**	**di**	**ff**	**fs**	**hc**	**hf**	**hp**	**hr**	**mm**	**oe**	**oh**	**ohf**	**ohs**	**or**	**rip**	**rw**	**st**	**svp**	**uc**	**vp**	**vpf**	**ww**	**yb**		
OBSERVED	Cliff Face	**cf**	5																							5	100
	Disturbed Area	**di**		8																						8	100
	American Sycamore - Tuliptree - Sweetgum Floodplain Forest	**ff**			6																					6	100
	Forest Seep	**fs**				4																				4	100
	Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest	**hc**					4															1				5	80
	Eastern Hemlock Floodplain Forest	**hf**						6																		6	100
	Eastern Hemlock Plateau Forest	**hp**							6																	6	100
	Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest	**hr**		1			1			5									3		1				1	12	42
	Sugar Maple - Yellow Buckeye - American Basswood Forest	**mm**									4															4	100
	Oak / Ericad Forest	**oe**										10														10	100
	Oak - Hickory Forest	**oh**											2		2				2							6	33
	Oak - Hickory Floodplain Forest	**ohf**												7												7	100
	Oak - Hickory - Sugar Maple Forest	**ohs**											1		4											5	80
	Oak / Great Laurel Forest	**or**		1			1									8			1							11	73
	Riparian Zone	**rip**															10									10	100
	American Sycamore - River Birch Riverscour Woodland	**rw**																5								5	100
	Successional Tuliptree Forest	**st**			1														4							5	80
	Successional (Virginia, Pitch) Pine Forest	**svp**	1																	12						13	92
	Utility Corridor	**uc**																			4					4	100
	Cliff Top Virginia Pine Forest	**vp**																				3				3	100
	(Virginia, Pitch) Pine Floodplain Forest	**vpf**																					8			8	100
	American Water-willow Cobble Bar	**ww**																						2		2	100
	Yellow Birch Cold Cove Forest	**yb**																							2	2	100
	Total		6	10	7	4	6	6	6	5	4	10	3	7	6	8	10	5	10	12	5	4	8	2	3	**147**	
	Producer's Accuracy (% correct)		83	80	86	100	67	100	100	100	100	100	67	100	67	100	100	100	40	100	80	75	100	100	67		

Total Points Correct	129
Overall Accuracy	87.76%
Kappa Index	87.12%
90% Confidence Interval	4.89%

Vegetation Mapping

The final vegetation map (Figure 5) for GARI includes 31 map classes covering a total of 4,555.26 ha (11,256.30 ac) within the park boundaries (Table 6). Approximately 89% of the park area is mapped as natural and semi-natural vegetation and an additional 6% is mapped as natural waterways. The remaining 5 % is mapped as cultural and disturbed areas and transportation features.

Upland communities comprise about 86% of the park area and are represented by 13 map classes. The Cliff Face and Successional (Virginia, Pitch) Pine Forest map classes each include patches of two USNVC associations (Table 7). All other upland community map classes represent single predominating associations in the USNVC as listed in Table 4, but polygons may have inclusions of other associations less than the minimum mapping unit (0.5 ha [1.23 ac]) and may grade towards adjacent polygons of related map classes. The most abundant map class in GARI is Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest, which covers about 43% of the park area. The five other most abundant map classes in GARI are, in descending order of abundance, Sugar Maple - Yellow Buckeye - American Basswood Forest, Oak - Hickory Forest, Oak - Hickory - Sugar Maple Forest, Eastern Hemlock Plateau Forest, and Oak / Great Laurel Forest. Together, these six most abundant map classes cover about 80% of the park area. Mixed evergreen-deciduous forests having a large component of eastern hemlock dominate the eastern two-thirds of the park. Deciduous forests dominate the western third of the park.

Riparian and wetland communities comprise about 2% of the park area and are represented by nine map classes. Riparian Zone is the most abundant map class in this group and may include patches of three USNVC associations (Table 7), but Riverscour Shrub Prairie is the dominant association in this map class. The other two associations in the map class, American Water-willow Cobble Bar and American Sycamore - River Birch Riverscour Woodland, occur as individual map classes as well. All other riparian and wetland community map classes represent single predominating associations in the USNVC as listed in Table 4.

Cultural areas include the Utility Corridor and Developed Area map classes which represent land without vegetation cover or with vegetation which is maintained by periodic, usually frequent, human management activities. Examples of developed areas mapped in GARI include agricultural hayfields and pastures, oil well sites, and recreational facilities (boat landings, parking lots, and camping areas).

The Disturbed Area map class represents land where natural vegetation has been significantly altered by recent human activities but which is not actively maintained by human activities. Disturbed areas typically have vegetation comprised of both native and exotic species with physiognomy often differing from typical natural stands in similar topographic positions. Examples of disturbed areas mapped in GARI include recently logged areas, areas disturbed by dam and bridge construction, and areas subject to heavy recreational use.

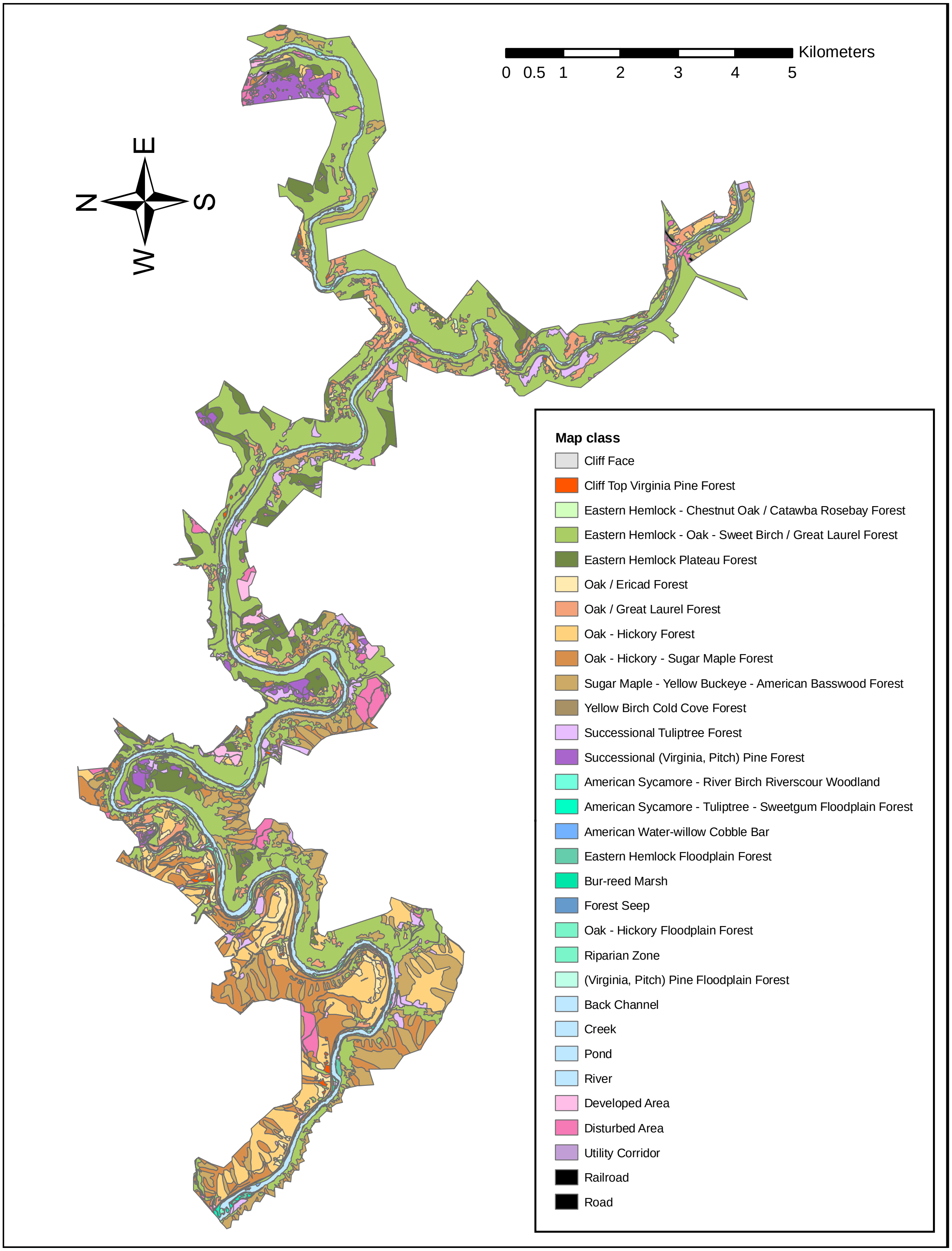

Figure 5. Final vegetation map of Gauley River National Recreation Area.

Table 6. Number of polygons and total area of vegetation map classes in Gauley River National Recreation Area.

Map Class	Map Class Name	Number of Polygons	Total Acres	Total Hectares
Upland communities				
cf	Cliff Face	82	21.50	8.70
vp	Cliff Top Virginia Pine Forest	60	38.85	16.13
hc	Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest	9	9.49	3.84
hr	Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest	264	4861.37	1967.33
hp	Eastern Hemlock Plateau Forest	109	601.11	243.26
oe	Oak / Ericad Forest	49	138.11	55.89
or	Oak / Great Laurel Forest	127	488.93	197.86
oh	Oak - Hickory Forest	180	1050.92	425.29
ohs	Oak - Hickory - Sugar Maple Forest	176	872.68	353.16
svp	Successional (Virginia, Pitch) Pine Forest	44	226.29	91.58
st	Successional Tuliptree Forest	114	335.09	135.61
mm	Sugar Maple - Yellow Buckeye - American Basswood Forest	157	1074.33	434.76
yb	Yellow Birch Cold Cove Forest	2	11.17	4.52
Total upland communities		1373	9730.86	3937.94
Riparian and wetland communities				
rw	American Sycamore - River Birch Riverscour Woodland	12	5.32	2.15
ff	American Sycamore - Tuliptree - Sweetgum Floodplain Forest	11	11.93	4.83
ww	American Water-willow Cobble Bar	3	1.40	0.57
bm	Bur-reed Marsh	1	0.07	0.03
hf	Eastern Hemlock Floodplain Forest	78	52.53	21.26
fs	Forest Seep	8	3.02	1.22
ohf	Oak - Hickory Floodplain Forest	5	7.24	2.93
rip	Riparian Zone	283	157.27	63.65
vpf	(Virginia, Pitch) Pine Floodplain Forest	13	12.60	5.10
Total riparian and wetland communities		414	251.37	101.73
Aquatic features				
bc	Back Channel	4	3.65	1.48
ck	Creek	10	12.94	5.24
po	Pond	3	1.72	0.70
ri	River	2	666.15	269.58
Total aquatic features		19	684.46	276.99
Cultural and disturbed areas				
de	Developed Area	82	112.97	45.72
di	Disturbed Area	157	282.22	114.21
uc	Utility Corridor	11	5.79	2.34
Total cultural and disturbed areas		250	400.98	162.28
Transportation features				
rr	Railroad	4	68.52	27.73
ro	Road	145	120.15	48.62
Total transportation features		149	188.67	76.35
Grand Total		2205	11256.34	4555.29

Table 7. Associations of the U. S. National Vegetation Classification (USNVC) occurring in complex map classes at Gauley River National Recreation Area (GARI).

Map Class	Map Class Name	GARI Community Type Names and USNVC Association Codes included in Map Class
cf	Cliff Face	Common Rock Tripe Cliff Face (CEGL004387) Dry Cliff Face (CEGL006435)
rip	Riparian Zone	American Water-willow Cobble Bar (CEGL004286) American Sycamore - River Birch Riverscour Woodland (CEGL003725) Riverscour Shrub Prairie (CEGL006623)
svp	Successional (Virginia, Pitch) Pine Forest	Successional Pitch Pine Forest (CEGL006304) Successional Virginia Pine Forest (CEGL002591)

Discussion

Vegetation patterns in GARI reflect environmental gradients related to geology, soils, solar exposure, disturbance regimes, and past land use.

Upland forests in the eastern two-thirds or so of the park are characterized by an abundance of eastern hemlock and/or great laurel (*Rhododendron maximum*). The distribution of these mixed deciduous-evergreen forest types broadly corresponds with geology mapped as the New River formation (Cardwell et al. 1968). The New River formation is composed primarily of near horizontal sandstone beds which weather to form coarse textured, strongly acidic, low fertility soils. Most cliffs in the park are formed from sandstones in the New River formation. The local moist climate, seepage from the horizontal sandstone layers, and well drained, acidic soils combine to provide a competitive advantage for dominance by eastern hemlock in most topographic positions in this area of the park. The Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest is the matrix forest on colluvial gorge slopes, Oak / Great Laurel Forests usually occupy gorge slopes with higher solar exposure, and Eastern Hemlock Plateau Forests occupy upper slopes and plateaus with residual soils. Small patch communities, which occupy specialized habitats in this area of the park, include the Cliff Top Virginia Pine Forest and Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest on upper slopes and cliff tops with high solar exposure and the Yellow Birch Cold Cove Forest on lower slopes with extremely low solar exposure.

Eastern hemlock is currently threatened by infestations of the hemlock woolly adelgid, an exotic insect pest first detected in the park in 2004 (Wood et al. 2009). Significant tree mortality caused by this pest seems unavoidable and is likely to have broad ecosystem effects on bird populations, stream temperatures and nutrient levels, and amounts of soil carbon, coarse woody debris, and fire fuel loads. Considering the abundance of eastern hemlock in GARI, its imminent decline is likely to represent the biggest change in forest composition since the logging era of the early 1900s.

In contrast to the eastern part of the park, upland forests in the western third or so of the park are strongly dominated by deciduous tree species, and eastern hemlock and great laurel become restricted to small areas of moist habitat. The distribution of these deciduous forests broadly corresponds with geology mapped as the Kanawha formation (Cardwell et al. 1968). The Kanawha formation includes sandstone and significant amounts of shale, siltstone, and coal which weather to form somewhat finer textured, somewhat more fertile soils compared to soils derived from the New River formation. In this deciduous zone, Sugar Maple - Yellow Buckeye - American Basswood Forests occupy positions with relatively low solar exposure, Oak - Hickory and Oak / Ericad Forests occupy positions with higher solar exposure, and Oak - Hickory - Sugar Maple Forests occupy intermediate positions.

Three successional forest types occur in areas which were cleared and subjected to ground disturbance in the past. Stands of Successional Pitch Pine Forest and Successional Virginia Pine Forest occur on plateaus formed on sandstone of the New River formation (Cardwell et al. 1968). Most stands on abandoned farmland are currently decadent and are reverting to dominance by eastern hemlock. In contrast, on land excavated for construction of Summersville Dam, younger

stands of Successional Virginia Pine Forest currently show little evidence of succession away from pine dominance. Successional Tuliptree Forest occurs in more mesic and/or more fertile landscape positions than the successional pine types. It occurs on gorge slopes and alluvial terraces, and on areas of plateaus mapped as the Kanawha formation (Cardwell et al. 1968). Low producer's accuracy of the Successional Tuliptree Forest map class suggests that it is overmapped, most notably at the expense of the Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest map class (Table 5).

Riparian and floodplain vegetation occupies a very small area in GARI but is represented by a disproportionately high number of associations. Small patches of Eastern Hemlock Floodplain Forest, (Virginia, Pitch) Pine Floodplain Forest, and Oak - Hickory Floodplain Forest occur on upper floodplains which are subject to infrequent, short duration, or low energy floods. These communities combine plant species typically found in upland habitats with species that are tolerant of flooding disturbance. Somewhat lower floodplains are occupied by American Sycamore - Tuliptree - Sweetgum Floodplain Forest. All of the floodplain forest types are threatened by camping and trampling, especially during the whitewater boating season. These flat, sandy sites are some of the only riverside areas suitable for camping. They are also some of the rarest community types in the park and their occurrences have been greatly diminished by construction of roads and railroads, and by other riverside development, both in GARI and throughout their ranges outside the park.

Riverscour communities occur below the floodplain forests in higher positions within the active river channel. These areas are subject to frequent, high energy floods which scour and shape bedrock exposures, deposit and remove sediments (boulders, cobble, sand), and control vegetation physiognomy. The American Sycamore - River Birch Riverscour Woodland occurs in higher positions in this zone. Two phases of American Sycamore - River Birch Riverscour Woodland can be recognized at GARI. The more common phase at GARI is represented by stands on cobble and boulder substrate, which are subject to more frequent, higher energy floods, and have more open canopies and herb layers with big bluestem (*Andropogon gerardii*) prominent in late season. The less common phase at GARI is represented by stands on sand substrate, which are subject to less frequent, lower energy floods, and have taller, more closed canopies, often dominated by river birch (*Betula nigra*) over lush, tall herb layers with abundant deertongue (*Dichanthelium clandestinum*) and Indian woodoats (*Chasmanthium latifolium*). The Riverscour Shrub Prairie, the major component of the Riparian Zone map class (Table 7), occupies areas where flooding disturbance maintains an open physiognomy by removing or damaging trees before they become large enough to provide significant shade. Riverscour communities at GARI have extremely high plant species richness and host a high concentration of rare plant species, including large populations of the federally listed threatened Virginia meadowsweet (*Spiraea virginiana*) and the globally rare Monongahela Barbara's buttons (*Marshallia grandiflora*).

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Appendix A. Vegetation plot field forms.

Form 3: Quantitative Community Characterization **Draft: Spring, 1993**

A. Identifiers (general EOR information) LFSP. 1

Sci. name: 1.SNAME: Hemlock / Rhododendron 2.GNAME:

3.Site name: CARNIFAX FERRY SP

4.Survey site name: PIERSON HOLLOW

5.Quad name(s): Summersville Dam 6.Quad code(s):

7.County name(s): Nicholas 8.County code(s):

9.Town (LOCALJURIS):

10.Lat: N 11.Long: 0 W 12.Directions:

Pierson Hollow in rocky zone just above river

UTM: 505912.6178 E 4228839.2657 N

13.Sourcecode: 2000JV015 14.Survey date: Sept. 8. 2000

15.Last obs: 16.First obs: 17.State: WV

18.Surveyors: Jim Vanderhorst, Brian Streets

photos 6,7,8

B. Environmental Description

19.Transect / Observation point #

20.Image annotation #

21.Elevation:

22.Topographic position:
- _Interfluve
- _High slope
- _High level
- _Midslope
- _Low level
- _Channel bed
- _Other
- _Backslope
- _Step in slope
- X Lowslope
- _Toeslope
- _Channel wall
- _Basin floor

23.Topographic sketch:

24.Slope degrees: 25°

25.Slope aspect: 180°

26.Parent material: sandstone

27.Soil profile description: note depth, texture, and color of each horizon. Note significant changes such as depth to mottling, depth to water table, root penetration depth (SOILCOM)

28.Organic horizon depth: 10 cm

29.Organic horizon type:

30.Average pH of mineral soil: 5

10 cm Litter

10YR 4/3 w/ mottle ave 6/3

Sandstone

31.Soil moisture regime:
- _Extremely dry
- _Very dry
- _Dry
- _Somewhat moist
- X Moist
- _Somewhat wet
- _Wet
- _Very wet
- _Permanently inundated
- _Periodically inundated

32.Stoniness:
- _Stone free <0.1%
- _Moderately stony 0.1-1%
- X Stony 3-15%
- _Very stony 15-50%
- _Exceedingly stony 50-90%
- _Stone piles >90%

33.Soil drainage:
- _Rapidly drained
- X Well drained
- _Moderately well drained
- _Somewhat poorly drained
- _Poorly drained
- _Very poorly drained

34.Average texture:
- _ sand
- X sandy loam
- _ loam
- _ silt loam
- _ other
- _ clay loam
- _ clay
- _ peat
- _ muck

35.Unvegetated surface:
- 10 % Bedrock
- 10 % Large rocks (cobbles, boulders > 10 cm)
- _ % Small rocks (gravel, 0.2-10 cm)
- _ % Sand (0.1-2 mm)
- _ % Bare soil
- 70 % Litter, duff
- 10 % Wood (> 1 cm)
- _ % Water
- _ % Other:

36.Environmental Comments: Note homogeneity of vegetation, erosion / sedimentation, inundation, etc. Old growth forest on colluvial lower slope dissected by streams w/ rock outcrops. Large trees include Quercus prinus, Betula lenta, Quercus rubra, Tsuga. Understory dominated by Tsuga and Rhododendron maximum. Much down wood (outside plot), snags, canopy gaps throughout community. Fire scar on Betula lenta in plot.

37.Plot representativeness: Old growth on cool rocky lower slopes of Gauley Gorge. Old growth centers on stream channel (Pierson Hollow)

Form 3. Quantitative Community Characterization, page 1.

C. Vegetation 38. System: X Terrestrial ___ Palustrine ___ Estuarine 39. Plot number: ____ 40. Plot dimensions: 20 × 20 m

41. Leaf type:
- X Broad-leaf
- Semi-broad-leaf
- Semi-needle-leaf
- X Needle-leaf
- Graminoid
- Broad-leaf herbaceous
- Pteridophyte

42. Leaf phenology:
- X Deciduous
- Semi-deciduous
- Semi-Evergreen
- X Evergreen
- Perennial
- Annual

43. Physiognomic type:
- X Forest
- Sparse woodland
- Shrubland
- Dwarf shrubland
- Sparse dwarf shrubland
- Non-vascular
- Woodland
- Scrub thicket
- Sparse shrubland
- Dwarf scrub thicket
- Herbaceous
- Sparsely vegetated

44.

	height	% cover
T1 Emergent tree		
T2 Tree canopy	26m	50
T3 Tree sub-canopy	15M	50
S1 Tall shrub	5M	40
S2 Short shrub	1m	
H Herbaceous		
N Non-vascular		
E Epiphyte		
V Vine / liana		

45. Species / percent cover: starting with uppermost stratum, list all species and % cover for each in the stratum. For forests and woodlands, list on a separate line below each tree species the DBH of all trees above 10 cm diameter. Separate the measurements with a comma and note whether in cm or inches.

T2 Quercus prinus	20	S1 Rhododendron maximum	40	Maianthemum canadensis	T
48, 80 (fire scar)		10		Rhododendron maximum	T
Quercus rubra	10	Tsuga canadensis	5	Conopholus americana	T
58 (no fire scar)		10, 10			
Betula lenta	10				
63 (fire scar)		S2			
Tsuga canadensis	10	Rhodendron maximum	T		
30, 60					
Liriodendron tulipifera	5				
32					
Acer rubrum 30	5				
Nyssa sylvatica 52	10				
Tsuga canadensis 13, 15, 18, 17	30				
23, 15, 11, 24, 28, 15 (dead), 19, 18					
Magnolia fraseri	10				
18, 25, 23					
Oxydendron arborea	5				
10, 24					
Acer rubrum	5				
21, 26					
Robinia pseudoacacia	T				
22 (dead), 16 (dead), 14 (dead)					
Magnolia acuminata	1				
13					

T3 T2

* many young Tsuga are bent over

63" DBH hemlock out of plot ~230 years.

Form 3. Quantitative Community Characterization, page 2.

West Virginia Natural Heritage Program, Vegetation Plot Form (woody version)

Environ. QC BPS 10/7/09

Revised Aug 2008

Identifiers

Plot code: GAR1.217
Location name: Gauley River NRA
County name: Nicholas
Sublocation: Lower Gauley River Right
Quad name: Ansted
Dominant vegetation: Pinus virginiana – Betula nigra / Kalmia latifolia woodland
Survey date: Sept 29, 2009 Time: 1230 PM Surveyors: Jim Vanderhorst, Brian Streets
Plot directions:

X dimension (m): 33 Y dimension (m): 12 Plot shape: rectangle
GPS file: AN092912A GPS feature: plot ☒ corrected ☐ raw ☐ map dot
Field UTM x: 491276 Field UTM y: 4229030
Corrected UTM x: 491276.323 Corrected UTM y: 4229028.975 Datum: NAD83

☒ Photos Camera: Olympus Photographer: BPS Roll #: Frame #:

Environmental data

Hydrology evidence: ☒ flood scour ☐ hydrophytes ☒ flotsam ☐ standing water ☐ soil features ☐ saturated soil ☐ other: e.g. crayfish holes

Hydrologic regime: ☐ permanently flooded ☐ semi-permanenty flooded ☐ seasonally flooded ☒ temporarily flooded ☐ intermittently flooded ☐ saturated ☐ moist ☐ somewhat moist ☐ dry ☐ unknown ☐ very dry ☐ extremely dry

Elevation (m): 216
Slope (°): 12 Aspect (°): 220
Slope shape-vert.: *concave straight convex undulating* (straight circled)
Slope shape-horiz.: *concave straight convex undulating* (undulating circled)
Landform: floodplain
Cowardin system: U P R L ?
Geologic unit:
Surficial geology: alluvium (boulders/sand)

Topographic sketch

Rosgen stream type: *A B C D DA E F G* / *1 2 3 4 5 6 a+ a b c c-*

Hummocks ___% ___% hollow height (cm): ___ ☐ peat ☐ tussocks ☐ roots ☐ tip mounds ☐ down wood ☐ woody stem clusters

Topographic position: ☐ interfluve ☐ backslope ☐ low level ☐ high slope ☐ step in slope ☐ channel wall ☐ high level ☐ lowslope ☒ channel bed ☐ midslope ☐ toeslope ☐ basin floor

Unvegetated surface (%): 10 litter/duff; ___ bedrock; 10 wood >1 cm; 30 lg rocks >10 cm; ___ water; ___ sm rocks .2-10 cm; ___ bare soil; 50 sand .1-2 mm; ___ other:

Stoniness: ☒ <.1% ☐ 15-50% ☐ .1-3% ☐ 50-90% ☐ 3-15% ☐ >90%

Soil drainage: ☐ rapid ☐ mod-poor ☒ well ☐ poor ☐ moderate ☐ very poor

Soil Depth to water table (cm):
Texture (mineral soil): Sand
pH (mineral soil): 6.5
Depth of organic soil (cm):
Depth to mottling (cm):
Pore water pH:
Pore water EC:
Pore water T (°C)
Soil map unit: DRF

Soil profile: *indicate depth, horizon, texture, matrix & mottle colors, redoximorphic features, peat decomposition, comments* ⇨

10YR 4/6
Sand
pH 6.5
20 cm
Cont.

Hydric indicators:
☒ Soil sample collected for lab analysis

Estimated stand size (ha): .1 Plot sampled after pine signature was delineated from photo!

Representativeness: Small patch. plot placed in widest portion of polygon, elsewhere this community may occur as a single line of pines.

Environmental condition: Bouldery beach downstream from the last rapids along the Gauley. Community is a woodland of mostly VA pine with river birch and shrubs. Includes mix of dry-sterile site indicators (pine, mt. laurel, gum) mixed with floodplain indicators (alder, Indian grass). Older pine are clustered around rocks but pine saplings occur in sand-rocks may provide protection from flooding.

Landscape context: Downstream river becomes wider, less rapid. Above plot is upland mesic oak forest, then railroad. Downhill is narrow zone of prairie. Up and downstream is riverscour woodland without pine.

Ranking: size: B condition: A context: B composite: BA

Disturbance: ☐ fire ☐ exotic plants ☒ trails/roads ☐ deer trails ☐ clearing ☐ insects ☐ grazing ☐ wind-ice damage ☐ other ☐ logging ☐ disease ☐ browsing ☐ ditching/hydro alteration
Comments: railroad

Animal use evidence:
☐ insects collected

33
12 | 400

West Virginia Natural Heritage Program Vegetation Plot Form, page 1.

Species QC BPS 10/7/09

Plot code GARI 217	Leaf phenology	Physiognomic class	Height class (m)		Stratum	Height (m)	% cover
Leaf type	☐ evergreen	☐ forest			T1 emergent tree		
☐ broad leaf	☐ cold-deciduous	☒ woodland	<.5	35-50	T2 tree canopy	10	40
☐ needle leaf	☒ mixed evergreen-deciduous	☐ shrubland	.6-1	>50	T3 tree sub-canopy		
☒ mixed broad/needle	☐ annual herb	☐ dwarf shrubland	1.1-2	float	S1 tall shrub	3	30
☐ graminoid	☐ perennial herb	☐ herbaceous	2.1-5	subm	S2 short shrub	<1	10
☐ broad-leaf herbaceous	☐ drought-deactivated	☐ non-vascular	5.1-10		H herbaceous	1	20
☐ pteridophyte		☐ floating aquatic	10.1-15		N non-vascular		5
☐ byrophyte	☒ Floristically complete? +, —	☐ submerged aquatic	15.1-20		A1 floating		
		☐ sparse vegetation	20.1-35		A2 submerged		

Start with uppermost stratum. Note 'cf.' for uncertain taxa, © for collection (add # when available). Phenology codes (fr), (fl), (v).

Woody species	T1	T2	T3	S1	S2	H	%TC	DBH *(note stratum; include age data if available)*
Pinus virginiana		25		T	1		26	(T2) 27, 22, 14, 26, 25
Quercus prinus		5						(T2) 33 – on top of rock
Betula nigra		5		5	T		10	(T2) 28 (S1) 7, 10, 7,
Alnus serrulata				3				
Juniperus virginiana				5				(S1) 10
Ilex opaca				5				(S1) 9, 7, 8
Diospyros virginica		5						(T2) 18
Acer saccharum				T				
Quercus alba				T	T		T	
Kalmia latifolia				5	2		7	
Liquidamber styraciflua				1	1			(S1) © BPS 3450
Vaccinium corymbosum				1	T			
Nyssa sylvatica					1			
Lonicera japonica					T			
Rhododendron arborescens					1			
Smilax glauca					T			
Tsuga canadensis				T	T		1	
Chionanthus virginicus					T			
Xanthorhiza simplicissima					2			

Species name BPS 3451	% cover		
Symphiotrichum patens var patens ©	1	Ilex verticillata	T
Symphiotrichum lateriflolius	T	(S2) Carya alba	P
Viola pedata	P	Fraxinus	T
Sorghastrum nutans	1	Physocarpus opulifolia	T
Packera paupercula	1	Hypericum hypericoides	T
Solidago simplex	1	(S1) Liriodendron tulipifera	P
Ipomea pandurata cf	T	Physocarpus opulifolia	T
Erigeron pulchellus	T	Cornus ammomum	T
Eurybia divaricata	T	Eleagnus umbellata	T
Deschampsia flexuosa	T	(S2) Gaylussacia bacatta	T
Dichanthelium dichotomum dic.	T	(S1) Euonymus americana	T
Mitchella repens	P	(S2) Rubus phoenicaulasius	T
Coreopsis tripteris	T	(S1) Carpinus caroliniana	T
Lysimachia quadrifolia	T	(S2) Lyonia ligustrina	T
Achillea millefolium	P		
Rudbeckia laciniata	T	(H) Eupatorium fistulosum	T
Zizia trifoliata	T	Dryopteris marginalis	P
Legume	T	Baptisia tinctorium	P
Dichanthelium laxiflorum	T	Eupatorium (3-nerved) © BPS3453	P
Potentilla canadensis	T	Iris cristata	T
Bidens frondosa	T	Liatris aspera cf.	T
Euphorbia corollata	T	Pityopsis graminifolia	T
Osmunda regalis	T	Galax aphylla © BPS 3452	P
Symphiotrichum boreale	P	SNAGS	
Panicum virgatum	T	(S1) 23 – Pinus, 11 – Pinus	
Dicanthelium polyanthes	P	(N) Lassallia papulosa	T

(+) Viola primulifolia P — Andropogon gerardii T

lichen on rock T, moss on rock (2)

West Virginia Natural Heritage Program Vegetation Plot Form, page 2.

Appendix B. Physiognomic type definitions.

FOREST: Trees usually over 5 m (16 ft) tall with crowns interlocking (generally forming 60–100% cover). Shrubs, herbs, and nonvascular plants may be present at any cover value.

WOODLAND: Open stands of trees usually over 5 m (16 ft) tall with crowns not usually touching (generally forming 25–60% cover). Shrubs, herbs, and nonvascular plants may be present at any cover value.

SHRUBLAND: Shrubs and/or small trees usually 0.5–5.0 m (1.6 to 16 ft) tall with individuals or clumps not touching to interlocking (generally forming >25% canopy cover). Trees may be present, but with cover of 10% or less. Herbs and nonvascular plants may be present at any cover value.

HERBACEOUS: Graminoids and/or forbs (including ferns) generally forming >10% cover. Trees, shrubs, and dwarf shrubs may be present, but with cover 10 percent or less. Nonvascular plants may be present at any cover value.

NON-VASCULAR: Non-vascular vegetation (bryophytes, lichen, or other non-vascular plants) with cover greater than 25%. Trees, shrubs, and herbs may be present, but with cover of 25% or less.

SPARSELY VEGETATED: Substrate is predominantly not vegetated, cover of trees, shrubs, herbs, and non-vascular vegetation combined is 25% or less.

Appendix C. Standard Accuracy Assessment Form for USGS/NPS Vegetation Mapping Program.

Plot Number ______________ Park __________ Date _____________ Observers ________________________________

Easting: _ _ _ _ _ _ E Northing _ _ _ _ _ _ _ N EPE/APE: ______ DOP: ____ Map datum: ________ Zone: ____

Topographic Description: _______________________ Elevation: ________ Aspect: ______ Canopy Closure: __________

Vegetation Association at Point: ____

Veg Assoc 1 w/in 50 m of point: ____

Veg Assoc 2 w/in 50 m of point: ____

Major Species by Strata:

____

____

Rationale for Classification:

____

____

____

Comments:

____

____

A table containing the fields that appear on this standard accuracy assessment form was created in ArcGIS and converted to a Trimble data dictionary file for use in the field. All field data were entered directly into the electronic data dictionary.

Descriptions of fields:

Plot Number: randomly generated in ArcGIS
Park: GARI - Gauley River National Recreation Area
Date: automatically generated in the field
Observers: name of observer
Easting / Northing: UTM coordinates automatically generated in field if GPS satellites were available, otherwise edited in ArcGIS after field data were collected
EPE / APE: estimated from GPS differential correction software if collected, otherwise estimated by observer
DOP: estimated from GPS software
Map Datum: NAD 83
Zone: 17N
Topographic Description: descriptors of slope steepness, shape of slope and position on slope
Elevation: calculated by the GPS software, otherwise taken from a topographic map
Aspect: measured to the nearest 1º Azimuth using a Silva ranger handcompass
Canopy Closure: ocular estimate in percent
Vegetation Association at Point: based on the vegetation key
Vegetation Association 1 and 2 within 50 m of point: based on vegetation key and distance to these are also recorded
Major species by strata: common names of major canopy trees seen at point
Rationale for Classification: indicate if it was a strong match to the vegetation key; if it was not record reasons why the match was not so good
Comments: any other comments

The following fields that are not on the standard form were added to the data dictionary:

Canopy height: measured to the nearest meter

Appendix D. State and global conservation status rank definitions.

West Virginia State Ranks

State ranks are assigned by the West Virginia Natural Heritage Program and refer to the conservation status of the element across its range within West Virginia.

Rank	Definition
S1	Five or fewer documented occurrences, or very few remaining individuals within the state. Extremely rare and critically imperiled; or because of some factor(s) making it especially vulnerable to extirpation.
S2	Six to 20 documented occurrences, or few remaining individuals within the state. Very rare and imperiled; or because of some factor(s) making it vulnerable to extirpation.
S3	Twenty-one to 100 documented occurrences. May be somewhat vulnerable to extirpation.
S4	Common and apparently secure with more than 100 occurrences.
S5	Very common and demonstrably secure.
SH	Historical. Species which have not been relocated within the last 20 years. May be rediscovered.
SR	Reported from state, but not yet verified.
SX	Believed extirpated. Little likelihood of rediscovery.
SU	Possibly rare, but status uncertain until more data are gathered.
S?	Unranked, or, if following a number, rank uncertain (ex. S2?).
SNR	Not ranked.

Global Ranks

Global ranks are assigned by NatureServe and refer to the conservation status across the global range of the element.

Global basic ranks

Rank	Definition
GX	Presumed Extinct (species) - Not located despite intensive searches and virtually no likelihood of rediscovery. Eliminated (ecological communities) - Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.
GH	Possibly Extinct (species) - Missing; known from only historical occurrences but still some hope of rediscovery. Presumed Eliminated - (Historic, ecological communities)-Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration, for example, American Chestnut Forest.
G1	Critically Imperiled - At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	Imperiled - At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3	Vulnerable - At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4	Apparently Secure - Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	Secure - Common; widespread and abundant.

Global variant ranks

Rank	Definition
G#G#	Range Rank - A numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community. A G2G3 rank would indicate that there is a roughly equal chance of G2 or G3 and other ranks are much less likely. Ranges cannot skip more than one rank (e.g., GU should be used rather than G1G4).
GU	Unrankable - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. Whenever possible, the most likely rank is assigned and a question mark qualifier may be added (e.g., G2?) to express minor uncertainty, or a range rank (e.g., G2G3) may be used to delineate the limits (range) of uncertainty.
GNR	Unranked - Global rank not yet assessed.
GNA	Not Applicable - A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

Global rank qualifiers

Rank	Definition
?	Inexact Numeric Rank - Denotes some uncertainty about the numeric rank (e.g. G3? - Believed most likely a G3, but some chance of either G2 or G4).
Q	Questionable taxonomy - Taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or the inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority conservation priority.
C	Captive or Cultivated Only - At present extant only in captivity or cultivation, or as a reintroduced population not yet established.

Infraspecific taxon conservation status ranks

Infraspecific taxa refer to subspecies, varieties and other designations below the level of the species. Infraspecific taxon status ranks (T-ranks) apply to plants and animal species only; these T-ranks do not apply to ecological communities.

Rank	Definition
T#	Infraspecific Taxon (trinomial) - The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above for global conservation status ranks. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A T-rank cannot imply the subspecies or variety is more abundant than the species as a whole-for example, a G1T2 cannot occur. A vertebrate animal population, such as those listed as distinct population segments under the U.S. Endangered Species Act, may be considered an infraspecific taxon and assigned a T-rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status. At this time, the T rank is not used for ecological communities.

Appendix E. Vascular and non-vascular plant, fungi, and lichen taxa found in plots and at accuracy assessment points in Gauley River National Recreation Area.

Nomenclature for vascular plants follows the Checklist and Atlas of the Vascular Flora of West Virginia (Harmon et al. 2006), except for *Dichanthelium* and *Panicum* which follow the Flora of North America (Freckmann and Lelong 2003). Nomenclature for mosses and liverworts (Bryophyta) follows the Annotated Checklist of the Hornworts, Liverworts, and Mosses of West Virginia (Studlar et al. 2002). Nomenclature for lichens (Ascomycota) follows A Cumulative Checklist for the Lichen-forming, Lichenicolous and Allied Fungi of the Continental United States and Canada (Esslinger 2009). Nomenclature for mushrooms (Ascomycota and Basiodmycota) follows Mushrooms of West Virginia and the Central Appalachians (Roody 2003). An asterisk following the common name indicates the taxon is not native to North America.

Scientific Name	**Common Name**	**Family**	**Division**
Abrothallus cladoniae R. Sant. & D. Hawksw.	lichen	Uncertain Lichen Family	Ascomycota
Acalypha rhomboidea Raf.	Virginia threeseed mercury	Euphorbiaceae	Magnoliophyta
Acalypha virginica L.	Virginia threeseed mercury	Euphorbiaceae	Magnoliophyta
Acer negundo L. var. *negundo*	boxelder	Aceraceae	Magnoliophyta
Acer nigrum Michx. f.	black maple	Aceraceae	Magnoliophyta
Acer pensylvanicum L.	striped maple	Aceraceae	Magnoliophyta
Acer rubrum L.	red maple	Aceraceae	Magnoliophyta
Acer saccharum Marsh. var. *saccharum*	sugar maple	Aceraceae	Magnoliophyta
Acer spicatum Lam.	mountain maple	Aceraceae	Magnoliophyta
Achillea millefolium L. var. *occidentalis* DC.	western yarrow*	Asteraceae	Magnoliophyta
Actaea L.	baneberry	Ranunculaceae	Magnoliophyta
Actaea racemosa L. var. *racemosa*	black bugbane	Ranunculaceae	Magnoliophyta
Adiantum pedatum L.	northern maidenhair	Adiantaceae	Polypodiophyta
Adlumia fungosa (Ait.) Greene ex B.S.P.	Allegheny vine	Fumariaceae	Magnoliophyta
Aesculus flava Ait.	yellow buckeye	Hippocastanaceae	Magnoliophyta
Ageratina altissima (L.) King & H.E. Robins. var. *altissima*	white snakeroot	Asteraceae	Magnoliophyta
Agrimonia L.	agrimony	Rosaceae	Magnoliophyta
Agrimonia rostellata Wallr.	beaked agrimony	Rosaceae	Magnoliophyta
Agrimonia striata Michx.	roadside agrimony	Rosaceae	Magnoliophyta
Agrostis gigantea Roth	redtop*	Poaceae	Magnoliophyta
Agrostis L.	bentgrass	Poaceae	Magnoliophyta
Agrostis perennans (Walt.) Tuckerman	upland bentgrass	Poaceae	Magnoliophyta
Ailanthus altissima (P. Mill.) Swingle	tree of heaven*	Simaroubaceae	Magnoliophyta
Alisma subcordatum Raf.	American water plantain	Alismataceae	Magnoliophyta
Alnus serrulata (Ait.) Willd.	hazel alder	Betulaceae	Magnoliophyta
Ambrosia artemisiifolia L. var. *elatior* (L.) Descourtils	annual ragweed	Asteraceae	Magnoliophyta
Ambrosia trifida L. var. *trifida*	great ragweed	Asteraceae	Magnoliophyta
Amelanchier arborea (Michx. f.) Fern. var. *arborea*	common serviceberry	Rosaceae	Magnoliophyta
Amelanchier Medik.	serviceberry	Rosaceae	Magnoliophyta
Amelanchier stolonifera Wieg.	running serviceberry	Rosaceae	Magnoliophyta
Amphicarpaea bracteata (L.) Fern.	American hogpeanut	Fabaceae	Magnoliophyta

Scientific Name	**Common Name**	**Family**	**Division**
Amphidium mougeotii (Bruch & Schimp. in B.S.G.) Schimp.	Mougeot's amphidium moss	Orthotrichaceae	Bryophyta
Andreaea rothii Web. & Mohr	Roth's andreaea moss	Andreaeaceae	Bryophyta
Andropogon gerardii Vitman	big bluestem	Poaceae	Magnoliophyta
Anemone lancifolia Pursh	mountain thimbleweed	Ranunculaceae	Magnoliophyta
Anemone quinquefolia L. var. *quinquefolia*	nightcaps	Ranunculaceae	Magnoliophyta
Angelica triquinata Michx.	filmy angelica	Apiaceae	Magnoliophyta
Anomodon attenuatus (Hedw.) Hüb.	anomodon moss	Anomodontaceae	Bryophyta
Antennaria plantaginifolia (L.) Richards.	woman's tobacco	Asteraceae	Magnoliophyta
Antennaria solitaria Rydb.	singlehead pussytoes	Asteraceae	Magnoliophyta
Anthoxanthum odoratum L. ssp. *odoratum*	sweet vernal grass*	Poaceae	Magnoliophyta
Apios americana Medik.	groundnut	Fabaceae	Magnoliophyta
Aplectrum hyemale (Muhl. ex Willd.) Torr.	Adam and Eve	Orchidaceae	Magnoliophyta
Apocynum cannabinum L.	Indianhemp	Apocynaceae	Magnoliophyta
Arabis canadensis L.	sicklepod	Brassicaceae	Magnoliophyta
Arabis laevigata (Muhl. ex Willd.) Poir. var. *laevigata*	smooth rockcress	Brassicaceae	Magnoliophyta
Aralia racemosa L. ssp. *racemosa*	American spikenard	Araliaceae	Magnoliophyta
Aralia spinosa L.	devil's walkingstick	Araliaceae	Magnoliophyta
Arisaema triphyllum (L.) Schott ssp. *triphyllum*	Jack in the pulpit	Araceae	Magnoliophyta
Aristolochia macrophylla Lam.	pipevine	Aristolochiaceae	Magnoliophyta
Aristolochia serpentaria L.	Virginia snakeroot	Aristolochiaceae	Magnoliophyta
Arnoglossum atriplicifolium (L.) H.E. Robins.	pale Indian plaintain	Asteraceae	Magnoliophyta
Asarum canadense L.	Canadian wildginger	Aristolochiaceae	Magnoliophyta
Asclepias incarnata L. ssp. *pulchra* (Ehrh. ex Willd.) Woods.	swamp milkweed	Asclepiadaceae	Magnoliophyta
Asclepias quadrifolia Jacq.	fourleaf milkweed	Asclepiadaceae	Magnoliophyta
Asclepias tuberosa L. ssp. *tuberosa*	butterfly milkweed	Asclepiadaceae	Magnoliophyta
Asimina triloba (L.) Dunal	pawpaw	Annonaceae	Magnoliophyta
Asplenium montanum Willd.	mountain spleenwort	Aspleniaceae	Polypodiophyta
Asplenium platyneuron (L.) B.S.P.	ebony spleenwort	Aspleniaceae	Polypodiophyta
Asplenium rhizophyllum L.	walking fern	Aspleniaceae	Polypodiophyta
Aster	aster	Asteraceae	Magnoliophyta
Athyrium filix-femina (L.) Roth	common ladyfern	Dryopteridaceae	Polypodiophyta
Athyrium filix-femina (L.) Roth var. *angustum* (Willd.) Lawson	northeastern lady fern	Dryopteridaceae	Polypodiophyta
Athyrium filix-femina (L.) Roth var. *asplenioides* (Michx.) Farw.	asplenium ladyfern	Dryopteridaceae	Polypodiophyta
Atrichum angustatum (Brid.) Bruch & Schimp. in B.S.G.	atrichum moss	Polytrichaceae	Bryophyta
Atrichum P. Beauv.	atrichum moss	Polytrichaceae	Bryophyta
Atrichum undulatum (Hedw.) P. Beauv.	undulate atrichum moss	Polytrichaceae	Bryophyta
Aulacomnium heterostichum (Hedw.) Bruch & Schimp. in B.S.G.	aulacomnium moss	Aulacomniaceae	Bryophyta
Aulacomnium palustre (Hedw.) Schwaegr.	aulacomnium moss	Aulacomniaceae	Bryophyta
Aureolaria flava (L.) Farw.	smooth yellow false foxglove	Scrophulariaceae	Magnoliophyta
Aureolaria Raf.	false foxglove	Scrophulariaceae	Magnoliophyta
Aureolaria virginica (L.) Pennell	downy yellow false foxglove	Scrophulariaceae	Magnoliophyta
Baptisia tinctoria (L.) R. Br. ex Ait. f.	horseflyweed	Fabaceae	Magnoliophyta
Bazzania trilobata (L.) Gray	common bazzania liverwort	Lepidoziaceae	Marchantiophyta

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Betula alleghaniensis Britt. var. *alleghaniensis*	yellow birch	Betulaceae	Magnoliophyta
*Betul*a L.	birch	Betulaceae	Magnoliophyta
Betula lenta L.	sweet birch	Betulaceae	Magnoliophyta
Betula nigra L.	river birch	Betulaceae	Magnoliophyta
Bidens coronata (L.) Britt.	crowned beggarticks	Asteraceae	Magnoliophyta
Bidens frondosa L.	devil's beggartick	Asteraceae	Magnoliophyta
Bidens L.	beggarticks	Asteraceae	Magnoliophyta
Bidens vulgata Greene	big devils beggartick	Asteraceae	Magnoliophyta
Boehmeria cylindrica (L.) Sw.	smallspike false nettle	Urticaceae	Magnoliophyta
Boletus	bolete mushroom	Boletaceae	Basidiomycota
Botrychium dissectum Spreng.	cutleaf grapefern	Ophioglossaceae	Polypodiophyta
Botrychium virginianum (L.) Sw.	rattlesnake fern	Ophioglossaceae	Polypodiophyta
Boykinia aconitifolia Nutt.	Allegheny brookfoam	Saxifragaceae	Magnoliophyta
Brachyelytrum erectum (Schreb. ex Spreng.) Beauv.	bearded shorthusk	Poaceae	Magnoliophyta
Brachyelytrum septentrionale (Babel) G. Tucker	northern shorthusk	Poaceae	Magnoliophyta
Brachythecium laetum (Brid.) B.S.G.	vega blanca	Brachytheciaceae	Bryophyta
Brachythecium plumosum (Hedw.) Schimp. in B.S.G.	brachythecium moss	Brachytheciaceae	Bryophyta
Brachythecium rutabulum (Hedw.) Schimp. in B.S.G.	brachythecium moss	Brachytheciaceae	Bryophyta
Brachythecium salebrosum (Web. & Mohr) Schimp. in B.S.G.	brachythecium moss	Brachytheciaceae	Bryophyta
Bromus pubescens Muhl. ex Willd.	hairy woodland brome	Poaceae	Magnoliophyta
Brotherella recurvans (Michx.) Fleisch.	recurved brotherella moss	Sematophyllaceae	Bryophyta
Bryoandersonia illecebra (Hedw.) Robins.	bryoandersonia moss	Brachytheciaceae	Bryophyta
Bryum Hedw.	bryum moss	Bryaceae	Bryophyta
Bryum pseudotriquetrum (Hedw.) Gaertn. et. al.	common green bryum moss	Bryaceae	Bryophyta
Campanulastrum americanum (L.) Small	American bellflower	Campanulaceae	Magnoliophyta
Campsis radicans (L.) Seem. ex Bureau	trumpet creeper	Bignoniaceae	Magnoliophyta
Campylium (Sull.) Mitt.	campylium moss	Amblystegiaceae	Bryophyta
Campylopus tallulensis Sull. & Lesq.	Tallul campylopus moss	Dicranaceae	Bryophyta
Cardamine concatenata (Michx.) Sw.	cutleaf toothwort	Brassicaceae	Magnoliophyta
Cardamine diphylla (Michx.) Wood	crinkleroot	Brassicaceae	Magnoliophyta
Cardamine hirsuta L.	hairy bittercress	Brassicaceae	Magnoliophyta
Cardamine parviflora L. var. *arenicola* (Britt.) O.E. Schulz	sand bittercress	Brassicaceae	Magnoliophyta
Carex aestivalis M.A. Curtis ex Gray	summer sedge	Cyperaceae	Magnoliophyta
Carex albursina Sheldon	white bear sedge	Cyperaceae	Magnoliophyta
Carex amphibola Steud.	eastern narrowleaf sedge	Cyperaceae	Magnoliophyta
Carex atlantica Bailey ssp. *atlantica*	prickly bog sedge	Cyperaceae	Magnoliophyta
Carex baileyi Britt.	Bailey's sedge	Cyperaceae	Magnoliophyta
Carex blanda Dewey	eastern woodland sedge	Cyperaceae	Magnoliophyta
Carex caroliniana Schwein.	Carolina sedge	Cyperaceae	Magnoliophyta
Carex communis Bailey var. *communis*	fibrousroot sedge	Cyperaceae	Magnoliophyta
Carex crinita Lam. var. *crinita*	fringed sedge	Cyperaceae	Magnoliophyta
Carex cumberlandensis Naczi, Kral & Bryson	Cumberland sedge	Cyperaceae	Magnoliophyta
Carex debilis Michx.	white edge sedge	Cyperaceae	Magnoliophyta
Carex debilis Michx. var. *rudgei* Bailey	white edge sedge	Cyperaceae	Magnoliophyta

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Carex digitalis Willd. var. *digitalis*	slender woodland sedge	Cyperaceae	Magnoliophyta
Carex festucacea Schkuhr ex Willd.	fescue sedge	Cyperaceae	Magnoliophyta
Carex gracilescens Steud.	slender looseflower sedge	Cyperaceae	Magnoliophyta
Carex gracillima Schwein.	graceful sedge	Cyperaceae	Magnoliophyta
Carex hirsutella Mackenzie	fuzzy wuzzy sedge	Cyperaceae	Magnoliophyta
Carex intumescens Rudge	greater bladder sedge	Cyperaceae	Magnoliophyta
Carex jamesii Schwein.	James' sedge	Cyperaceae	Magnoliophyta
Carex L.	sedge	Cyperaceae	Magnoliophyta
Carex laxiculmis Schwein.	spreading sedge	Cyperaceae	Magnoliophyta
Carex laxiculmis Schwein. var. *laxiculmis*	spreading sedge	Cyperaceae	Magnoliophyta
Carex laxiflora Lam.	broad looseflower sedge	Cyperaceae	Magnoliophyta
Carex leptalea Wahlenb. ssp. *leptalea*	bristlystalked sedge	Cyperaceae	Magnoliophyta
Carex lurida Wahlenb.	shallow sedge	Cyperaceae	Magnoliophyta
Carex pensylvanica Lam.	Pennsylvania sedge	Cyperaceae	Magnoliophyta
Carex plantaginea Lam.	plantainleaf sedge	Cyperaceae	Magnoliophyta
Carex platyphylla Carey	broadleaf sedge	Cyperaceae	Magnoliophyta
Carex prasina Wahlenb.	drooping sedge	Cyperaceae	Magnoliophyta
Carex radiata (Wahlenb.) Small	eastern star sedge	Cyperaceae	Magnoliophyta
Carex rosea Schkuhr ex Willd.	rosy sedge	Cyperaceae	Magnoliophyta
Carex scabrata Schwein.	eastern rough sedge	Cyperaceae	Magnoliophyta
Carex seorsa Howe	weak stellate sedge	Cyperaceae	Magnoliophyta
Carex swanii (Fern.) Mackenzie	Swan's sedge	Cyperaceae	Magnoliophyta
Carex torta Boott ex Tuckerman	twisted sedge	Cyperaceae	Magnoliophyta
Carex virescens Muhl. ex Willd.	ribbed sedge	Cyperaceae	Magnoliophyta
Carex willdenowii Schkuhr ex Willd.	Willdenow's sedge	Cyperaceae	Magnoliophyta
Carpinus caroliniana Walt. ssp. *virginiana* (Marsh.) Furlow	American hornbeam	Betulaceae	Magnoliophyta
Carya alba (L.) Nutt. ex Ell.	mockernut hickory	Juglandaceae	Magnoliophyta
Carya cordiformis (Wangenh.) K. Koch	bitternut hickory	Juglandaceae	Magnoliophyta
Carya glabra (P. Mill.) Sweet	pignut hickory	Juglandaceae	Magnoliophyta
Carya Nutt.	hickory	Juglandaceae	Magnoliophyta
Carya ovalis (Wangenh.) Sarg.	red hickory	Juglandaceae	Magnoliophyta
Carya ovata (P. Mill.) K. Koch	shagbark hickory	Juglandaceae	Magnoliophyta
Castanea dentata (Marsh.) Borkh.	American chestnut	Fagaceae	Magnoliophyta
Castanea P. Mill.	chestnut	Fagaceae	Magnoliophyta
Catalpa bignonioides Walt.	southern catalpa	Bignoniaceae	Magnoliophyta
Catalpa Scop.	catalpa	Bignoniaceae	Magnoliophyta
Caulophyllum thalictroides (L.) Michx.	blue cohosh	Berberidaceae	Magnoliophyta
Cephalanthus occidentalis L.	common buttonbush	Rubiaceae	Magnoliophyta
Cercis canadensis L. var. *canadensis*	eastern redbud	Fabaceae	Magnoliophyta
Chasmanthium latifolium (Michx.) Yates	Indian woodoats	Poaceae	Magnoliophyta
Chelone glabra L.	white turtlehead	Scrophulariaceae	Magnoliophyta
Chimaphila maculata (L.) Pursh	striped prince's pine	Pyrolaceae	Magnoliophyta
Chionanthus virginicus L.	white fringetree	Oleaceae	Magnoliophyta
Chrysopsis mariana (L.) Ell.	Maryland goldenaster	Asteraceae	Magnoliophyta
Chrysothrix insulizans R.C. Harris & Ladd	lichen	Chrysotrichaceae	Ascomycota
Cicuta maculata L. var. *maculata*	spotted water hemlock	Apiaceae	Magnoliophyta
Cinna arundinacea L.	sweet woodreed	Poaceae	Magnoliophyta
Circaea lutetiana L. ssp. *canadensis* (L.) Aschers. & Magnus	broadleaf enchanter's nightshade	Onagraceae	Magnoliophyta
Cirsium P. Mill.	thistle	Asteraceae	Magnoliophyta
Cladonia caroliniana Tuck.	Carolina cup lichen	Cladoniaceae	Ascomycota
Cladonia cristatella Tuck.	cup lichen	Cladoniaceae	Ascomycota

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Cladonia cylindrica (A. Evans) A. Evans	cylinder cup lichen	Cladoniaceae	Ascomycota
Cladonia fimbriata (L.) Fr.	cup lichen	Cladoniaceae	Ascomycota
Cladonia furcata (Hudson) Schrader	cup lichen	Cladoniaceae	Ascomycota
Cladonia P. Browne	cup lichen	Cladoniaceae	Ascomycota
Cladonia pyxidata (L.) Hoffm.	cup lichen	Cladoniaceae	Ascomycota
Cladonia rangiferina (L.) F. H. Wigg.	grey reindeer lichen	Cladoniaceae	Ascomycota
Cladonia squamosa Hoffm.	cup lichen	Cladoniaceae	Ascomycota
Cladonia subtenuis (Abbayes) Hale & Culb.	dixie reindeer lichen	Cladoniaceae	Ascomycota
Cladonia uncialis (L.) F. H. Wigg.	cup lichen	Cladoniaceae	Ascomycota
Clematis virginiana L.	devil's darning needles	Ranunculaceae	Magnoliophyta
Clethra acuminata Michx.	mountain sweetpepperbush	Clethraceae	Magnoliophyta
Climacium americanum Brid.	American climacium moss	Climaciaceae	Bryophyta
Coccocarpia palmicola (Spreng.) Arv. & D.J. Galloway	coccocarpia lichen	Coccocarpiaceae	Ascomycota
Collinsonia canadensis L.	richweed	Lamiaceae	Magnoliophyta
Conocephalum conicum (L.) Dumort.	conehead chamber liverwort	Conocephalaceae	Marchantiophyta
Conopholis americana (L.) Wallr. f.	American squawroot	Orobanchaceae	Magnoliophyta
Coreopsis L.	tickseed	Asteraceae	Magnoliophyta
Coreopsis major Walt.	greater tickseed	Asteraceae	Magnoliophyta
Coreopsis pubescens Ell. var. *pubescens*	star tickseed	Asteraceae	Magnoliophyta
Coreopsis tripteris L.	tall tickseed	Asteraceae	Magnoliophyta
Cornus alternifolia L. f.	alternateleaf dogwood	Cornaceae	Magnoliophyta
Cornus amomum P. Mill.	silky dogwood	Cornaceae	Magnoliophyta
Cornus florida L.	flowering dogwood	Cornaceae	Magnoliophyta
Cornus L.	dogwood	Cornaceae	Magnoliophyta
Corylus americana Walt.	American hazelnut	Betulaceae	Magnoliophyta
Crataegus L.	hawthorn	Rosaceae	Magnoliophyta
Crepis pulchra L.	smallflower hawksbeard*	Asteraceae	Magnoliophyta
Cryptotaenia canadensis (L.) DC.	Canadian honewort	Apiaceae	Magnoliophyta
Cunila origanoides (L.) Britt.	common dittany	Lamiaceae	Magnoliophyta
Cuscuta pentagona Engelm. var. *pentagona*	fiveangled dodder	Cuscutaceae	Magnoliophyta
Cymophyllus fraserianus (Ker-Gawl.) Kartesz & Gandhi	Fraser's cymophyllus	Cyperaceae	Magnoliophyta
Cynoglossum virginianum L. var. *virginianum*	wild comfrey	Boraginaceae	Magnoliophyta
Cyperus strigosus L.	strawcolored flatsedge	Cyperaceae	Magnoliophyta
Cypripedium acaule Ait.	moccasin flower	Orchidaceae	Magnoliophyta
Danthonia compressa Austin ex Peck	flattened oatgrass	Poaceae	Magnoliophyta
Danthonia DC.	oatgrass	Poaceae	Magnoliophyta
Danthonia sericea Nutt.	downy danthonia	Poaceae	Magnoliophyta
Danthonia spicata (L.) Beauv. ex Roemer & J.A. Schultes	poverty oatgrass	Poaceae	Magnoliophyta
Daucus carota L.	Queen Anne's lace*	Apiaceae	Magnoliophyta
Delphinium tricorne Michx.	dwarf larkspur	Ranunculaceae	Magnoliophyta
Dennstaedtia punctilobula (Michx.) T. Moore	eastern hayscented fern	Dennstaedtiaceae	Polypodiophyta
Deparia acrostichoides (Sw.) M. Kato	silver false spleenwort	Dryopteridaceae	Polypodiophyta
Dermatocarpon luridum (With.) J. R. Laundon	silverskin lichen	Verrucariaceae	Ascomycota
Deschampsia flexuosa (L.) Trin. var. *flexuosa*	wavy hairgrass	Poaceae	Magnoliophyta
Desmodium Desv.	ticktrefoil	Fabaceae	Magnoliophyta

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Desmodium glutinosum (Muhl. ex Willd.) Wood	pointedleaf ticktrefoil	Fabaceae	Magnoliophyta
Desmodium nudiflorum (L.) DC.	nakedflower ticktrefoil	Fabaceae	Magnoliophyta
Desmodium paniculatum (L.) DC. var. *paniculatum*	panicledleaf ticktrefoil	Fabaceae	Magnoliophyta
Desmodium pauciflorum (Nutt.) DC.	fewflower ticktrefoil	Fabaceae	Magnoliophyta
Desmodium rotundifolium DC.	prostrate ticktrefoil	Fabaceae	Magnoliophyta
Diarrhena americana Beauv.	American beakgrain	Poaceae	Magnoliophyta
Dicentra Bernh.	bleeding heart	Fumariaceae	Magnoliophyta
Dicentra canadensis (Goldie) Walp.	squirrel corn	Fumariaceae	Magnoliophyta
Dichanthelium (A.S. Hitchc. & Chase) Gould	rosette grass	Poaceae	Magnoliophyta
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark ssp. *columbianum* (Scribn.) Freckmann & Lelong	District of Columbia panicgrass	Poaceae	Magnoliophyta
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark ssp. *fasciculatum* (Torr.) Freckmann & Lelong	western panicgrass	Poaceae	Magnoliophyta
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark ssp. *implicatum* (Scribn.) Freckmann & Lelong	western panicgrass	Poaceae	Magnoliophyta
Dichanthelium boscii (Poir.) Gould & C.A. Clark	Bosc's panicgrass	Poaceae	Magnoliophyta
Dichanthelium clandestinum (L.) Gould	deertongue	Poaceae	Magnoliophyta
Dichanthelium commutatum (J.A. Schultes) Gould	variable panicgrass	Poaceae	Magnoliophyta
Dichanthelium commutatum (J.A. Schultes) Gould ssp. *ashei* (T.G. Pearson ex Ashei) Freckmann & Lelong	variable panicgrass	Poaceae	Magnoliophyta
Dichanthelium commutatum (J.A. Schultes) Gould ssp. *commutatum*	variable panicgrass	Poaceae	Magnoliophyta
Dichanthelium dichotomum (L.) Gould	cypress panicgrass	Poaceae	Magnoliophyta
Dichanthelium dichotomum (L.) Gould ssp. *dichotomum*	forked panicgrass	Poaceae	Magnoliophyta
Dichanthelium dichotomum (L.) Gould ssp. *microcarpon* (Muhl. ex Elliott) Freckmann & Lelong	forked panicgrass	Poaceae	Magnoliophyta
Dichanthelium dichotomum (L.) Gould ssp. *yadkinense* (Ashe) Freckmann & Lelong	forked panicgrass	Poaceae	Magnoliophyta
Dichanthelium latifolium (L.) Gould & C.A. Clark	broadleaf rosette grass	Poaceae	Magnoliophyta
Dichanthelium laxiflorum (Lam.) Gould	openflower rosette grass	Poaceae	Magnoliophyta
Dichanthelium linearifolium (Scribn. ex Nash) Gould	slimleaf panicgrass	Poaceae	Magnoliophyta
Dichanthelium ovale (Elliott) Gould & C.A. Clark ssp. *villosissimum* (Nash) Freckmann & Lelong	stiff-leaved panicgrass	Poaceae	Magnoliophyta
Dichanthelium polyanthes (Shult.) Mohlenbr.	roundseed panicgrass	Poaceae	Magnoliophyta
Dicranella (C. Müll.) Schimp.	dicranella moss	Dicranaceae	Bryophyta
Dicranella heteromalla (Hedw.) Schimp.	dicranella moss	Dicranaceae	Bryophyta
Dicranum condensatum Hedw.	condensed dicranum moss	Dicranaceae	Bryophyta
Dicranum flagellare Hedw.	dicranum moss	Dicranaceae	Bryophyta

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Dicranum fulvum Hook.	dicranum moss	Dicranaceae	Bryophyta
Dicranum fuscescens Turn.	dicranum moss	Dicranaceae	Bryophyta
Dicranum Hedw.	dicranum moss	Dicranaceae	Bryophyta
Dicranum scoparium Hedw.	dicranum moss	Dicranaceae	Bryophyta
Dicranum spurium Hedw.	dicranum moss	Dicranaceae	Bryophyta
Dioscorea L.	yam	Dioscoreaceae	Magnoliophyta
Dioscorea quaternata J.F. Gmel.	fourleaf yam	Dioscoreaceae	Magnoliophyta
Diospyros virginiana L.	common persimmon	Ebenaceae	Magnoliophyta
Diplazium pycnocarpon (Spreng.) Broun	glade fern	Dryopteridaceae	Polypodiophyta
Diplophyllum apiculatum (A. Evans) Steph.	pointed mitten liverwort	Scapaniaceae	Marchantiophyta
Doellingeria umbellata (P. Mill.) Nees var. *umbellata*	parasol whitetop	Asteraceae	Magnoliophyta
Dryopteris goldiana (Hook. ex Goldie) Gray	Goldie's woodfern	Dryopteridaceae	Polypodiophyta
Dryopteris intermedia (Muhl. ex Willd.) Gray	intermediate woodfern	Dryopteridaceae	Polypodiophyta
Dryopteris marginalis (L.) Gray	marginal woodfern	Dryopteridaceae	Polypodiophyta
Duchesnea indica (Andr.) Focke	Indian strawberry*	Rosaceae	Magnoliophyta
Elaeagnus umbellata Thunb. var. *parvifolia* (Royle) Schneid.	autumn olive*	Elaeagnaceae	Magnoliophyta
Eleocharis acicularis (L.) Roemer & J.A. Schultes var. *acicularis*	needle spikerush	Cyperaceae	Magnoliophyta
Eleocharis obtusa (Willd.) J.A. Schultes	blunt spikerush	Cyperaceae	Magnoliophyta
Eleocharis tenuis (Willd.) J.A. Schultes	slender spikerush	Cyperaceae	Magnoliophyta
Elephantopus carolinianus Raeusch.	Carolina elephantsfoot	Asteraceae	Magnoliophyta
Elymus canadensis L.	Canada wildrye	Poaceae	Magnoliophyta
Elymus hystrix L. var. *hystrix*	eastern bottlebrush grass	Poaceae	Magnoliophyta
Elymus riparius Wieg.	riverbank wildrye	Poaceae	Magnoliophyta
Entodon seductrix (Hedw.) C. Müll.	seductive entodon moss	Entodontaceae	Bryophyta
Epifagus virginiana (L.) W. Bart.	beechdrops	Orobanchaceae	Magnoliophyta
Epigaea repens L.	trailing arbutus	Ericaceae	Magnoliophyta
Equisetum arvense L.	field horsetail	Equisetaceae	Equisetophyta
Erigeron L.	fleabane	Asteraceae	Magnoliophyta
Erigeron philadelphicus L. var. *philadelphicus*	Philadelphia fleabane	Asteraceae	Magnoliophyta
Erigeron pulchellus Michx.	robin's plantain	Asteraceae	Magnoliophyta
Erigeron pulchellus Michx. var. *brauniae* Fern.	Braun's erigeron	Asteraceae	Magnoliophyta
Euonymus americana L.	strawberry bush	Celastraceae	Magnoliophyta
Eupatorium album L.	white thoroughwort	Asteraceae	Magnoliophyta
Eupatorium fistulosum Barratt	trumpetweed	Asteraceae	Magnoliophyta
Eupatorium godfreyanum Cronq.	Godfrey's thoroughwort	Asteraceae	Magnoliophyta
Eupatorium L.	thoroughwort	Asteraceae	Magnoliophyta
Eupatorium perfoliatum L. var. *perfoliatum*	common boneset	Asteraceae	Magnoliophyta
Eupatorium purpureum L. var. *purpureum*	sweetscented joepyeweed	Asteraceae	Magnoliophyta
Eupatorium rotundifolium L. var. *ovatum* (Bigelow) Torr.	roundleaf thoroughwort	Asteraceae	Magnoliophyta
Euphorbia corollata L.	flowering spurge	Euphorbiaceae	Magnoliophyta
Eurhynchium hians (Hedw.) Sande Lac.	eurhynchium moss	Brachytheciaceae	Bryophyta
Eurybia (Cass.) S.F. Gray	aster	Asteraceae	Magnoliophyta
Eurybia divaricata (L.) Nesom	white wood aster	Asteraceae	Magnoliophyta
Eurybia schreberi (Nees) Nees	Schreber's aster	Asteraceae	Magnoliophyta

Scientific Name	Common Name	Family	Division
Euthamia graminifolia (L.) Nutt. var. *graminifolia*	flat-top goldentop	Asteraceae	Magnoliophyta
Fagus grandifolia Ehrh.	American beech	Fagaceae	Magnoliophyta
Festuca subverticillata (Pers.) Alexeev	nodding fescue	Poaceae	Magnoliophyta
Fissidens dubius P. Beauv.	fissidens moss	Fissidentaceae	Bryophyta
Fissidens Hedw.	fissidens moss	Fissidentaceae	Bryophyta
Fissidens osmundioides Hedw.	osmund fissidens moss	Fissidentaceae	Bryophyta
Flavoparmelia baltimorensis (Gyelnik & Foriss) Hale	lichen	Parmeliaceae	Ascomycota
Flavoparmelia caperata (L.) Hale	lichen	Parmeliaceae	Ascomycota
Fraxinus americana L.	white ash	Oleaceae	Magnoliophyta
Fraxinus L.	ash	Oleaceae	Magnoliophyta
Fraxinus pennsylvanica Marsh.	green ash	Oleaceae	Magnoliophyta
Frullania asagrayana Mont.	bronze cup liverwort	Jubulaceae	Marchantiophyta
Galax urceolata (Poir.) Brummitt	beetleweed	Diapensiaceae	Magnoliophyta
Galium aparine L.	stickywilly	Rubiaceae	Magnoliophyta
Galium circaezans Michx.	licorice bedstraw	Rubiaceae	Magnoliophyta
Galium circaezans Michx. var. *circaezans*	licorice bedstraw	Rubiaceae	Magnoliophyta
Galium circaezans Michx. var. *hypomalacum* Fern.	licorice bedstraw	Rubiaceae	Magnoliophyta
Galium L.	bedstraw	Rubiaceae	Magnoliophyta
Galium lanceolatum Torr.	lanceleaf wild licorice	Rubiaceae	Magnoliophyta
Galium latifolium Michx.	purple bedstraw	Rubiaceae	Magnoliophyta
Galium tinctorium L.	stiff marsh bedstraw	Rubiaceae	Magnoliophyta
Galium triflorum Michx.	fragrant bedstraw	Rubiaceae	Magnoliophyta
Ganoderma tsugae Murrill	hemlock polypore	Ganodermataceae	Basidiomycota
Gaultheria procumbens L.	eastern teaberry	Ericaceae	Magnoliophyta
Gaylussacia baccata (Wangenh.) K. Koch	black huckleberry	Ericaceae	Magnoliophyta
Geranium maculatum L.	spotted geranium	Geraniaceae	Magnoliophyta
Geum canadense Jacq. var. *canadense*	white avens	Rosaceae	Magnoliophyta
Geum L.	avens	Rosaceae	Magnoliophyta
Geum virginianum L.	cream avens	Rosaceae	Magnoliophyta
Glechoma hederacea L.	ground ivy*	Lamiaceae	Magnoliophyta
Glyceria striata (Lam.) A.S. Hitchc.	fowl mannagrass	Poaceae	Magnoliophyta
Goodyera pubescens (Willd.) R. Br. ex Ait. f.	downy rattlesnake plantain	Orchidaceae	Magnoliophyta
Grimmia Hedw.	grimmia dry rock moss	Graimmiaceae	Bryophyta
Grimmia laevigata (Brid.) Brid.	grimmia dry rock moss	Graimmiaceae	Bryophyta
Grimmia pilifera P. Beauv.	grimmia dry rock moss	Grimmiaceae	Bryophyta
Hamamelis virginiana L.	American witchhazel	Hamamelidaceae	Magnoliophyta
Hedwigia ciliata (Hedw.) P. Beauv.	ciliate hedwigia moss	Hedwigiaceae	Bryophyta
Helenium autumnale L. var. *autumnale*	common sneezeweed	Asteraceae	Magnoliophyta
Helianthus decapetalus L.	thinleaf sunflower	Asteraceae	Magnoliophyta
Helianthus divaricatus L.	woodland sunflower	Asteraceae	Magnoliophyta
Helianthus giganteus L.	giant sunflower	Asteraceae	Magnoliophyta
Helianthus L.	sunflower	Asteraceae	Magnoliophyta
Helianthus strumosus L.	paleleaf woodland sunflower	Asteraceae	Magnoliophyta
Heliopsis helianthoides (L.) Sweet	smooth oxeye	Asteraceae	Magnoliophyta
Hemerocallis fulva (L.) L.	orange daylily*	Liliaceae	Magnoliophyta
Hepatica nobilis Schreb. var. *acuta* (Pursh) Steyermark	sharplobe hepatica	Ranunculaceae	Magnoliophyta
Heuchera americana L. var. *americana*	American alumroot	Saxifragaceae	Magnoliophyta
Heuchera L.	alumroot	Saxifragaceae	Magnoliophyta

Scientific Name	**Common Name**	**Family**	**Division**
Heuchera villosa Michx. var. villosa	hairy alumroot	Saxifragaceae	Magnoliophyta
Hexastylis virginica (L.) Small	Virginia heartleaf	Aristolochiaceae	Magnoliophyta
Hieracium caespitosum Dumort.	meadow hawkweed*	Asteraceae	Magnoliophyta
Hieracium paniculatum L.	Allegheny hawkweed	Asteraceae	Magnoliophyta
Hieracium venosum L.	rattlesnakeweed	Asteraceae	Magnoliophyta
Houstonia caerulea L.	azure bluet	Rubiaceae	Magnoliophyta
Houstonia longifolia Gaertn.	longleaf summer bluet	Rubiaceae	Magnoliophyta
Houstonia serpyllifolia Michx.	thymeleaf bluet	Rubiaceae	Magnoliophyta
Hybanthus concolor (T.F. Forst.) Spreng.	eastern greenviolet	Violaceae	Magnoliophyta
Hydrangea arborescens L.	wild hydrangea	Hydrangeaceae	Magnoliophyta
Hydrastis canadensis L.	goldenseal	Ranunculaceae	Magnoliophyta
Hydrophyllum canadense L.	bluntleaf waterleaf	Hydrophyllaceae	Magnoliophyta
Hygrohypnum eugyrium (Schimp. in B.S.G.) Loeske	hygrohypnum moss	Hypnaceae	Bryophyta
Hypericum densiflorum Pursh	bushy St. Johnswort	Clusiaceae	Magnoliophyta
Hypericum ellipticum Hook.	pale St. Johnswort	Clusiaceae	Magnoliophyta
Hypericum hypericoides (L.) Crantz ssp. *multicaule* (Michx. ex Willd.) Robson	St. Andrew's cross	Clusiaceae	Magnoliophyta
Hypericum mutilum L.	dwarf St. Johnswort	Clusiaceae	Magnoliophyta
Hypericum perforatum L.	common St. Johnswort*	Clusiaceae	Magnoliophyta
Hypericum prolificum L.	shrubby St. Johnswort	Clusiaceae	Magnoliophyta
Hypericum punctatum Lam.	spotted St. Johnswort	Clusiaceae	Magnoliophyta
Hypnum curvifolium Hedw.	curveleaf hypnum moss	Hypnaceae	Bryophyta
Hypnum Hedw.	hypnum moss	Hypnaceae	Bryophyta
Hypnum imponens Hedw.	hypnum moss	Hypnaceae	Bryophyta
Hypoxis hirsuta (L.) Coville	common goldstar	Liliaceae	Magnoliophyta
Ilex montana Torr. & Gray ex Gray	mountain holly	Aquifoliaceae	Magnoliophyta
Ilex opaca Ait. var. *opaca*	American holly	Aquifoliaceae	Magnoliophyta
Ilex verticillata (L.) Gray	common winterberry	Aquifoliaceae	Magnoliophyta
Impatiens capensis Meerb.	jewelweed	Balsaminaceae	Magnoliophyta
Impatiens L.	touch-me-not	Balsaminaceae	Magnoliophyta
Impatiens pallida Nutt.	pale touch-me-not	Balsaminaceae	Magnoliophyta
Ionactis linariifolius (L.) Greene	flaxleaf whitetop aster	Asteraceae	Magnoliophyta
Ipomoea L.	morning-glory	Convolvulaceae	Magnoliophyta
Ipomoea pandurata (L.) G.F.W. Mey.	man of the earth	Convolvulaceae	Magnoliophyta
Iris cristata Ait.	dwarf crested iris	Iridaceae	Magnoliophyta
Iris L.	iris	Iridaceae	Magnoliophyta
Isoetes engelmannii A. Braun	Appalachian quillwort	Isoδtaceae	Lycopodiophyta
Juglans cinerea L.	butternut	Juglandaceae	Magnoliophyta
Juglans nigra L.	black walnut	Juglandaceae	Magnoliophyta
Juncus acuminatus Michx.	tapertip rush	Juncaceae	Magnoliophyta
Juncus dudleyi Wieg.	Dudley's rush	Juncaceae	Magnoliophyta
Juncus effusus L.	common rush	Juncaceae	Magnoliophyta
Juncus L.	rush	Juncaceae	Magnoliophyta
Juncus marginatus Rostk.	grassleaf rush	Juncaceae	Magnoliophyta
Juncus tenuis Willd.	poverty rush	Juncaceae	Magnoliophyta
Juniperus virginiana L. var. *virginiana*	eastern redcedar	Cupressaceae	Pinophyta
Justicia americana (L.) Vahl	American water-willow	Acanthaceae	Magnoliophyta
Kalmia latifolia L.	mountain laurel	Ericaceae	Magnoliophyta
Krigia biflora (Walt.) Blake var. *biflora*	twoflower dwarfdandelion	Asteraceae	Magnoliophyta
Lactarius	milk cap mushroom	Russulaceae	Basidiomycota
Lactuca canadensis L.	Canada lettuce	Asteraceae	Magnoliophyta
Lactuca L.	lettuce	Asteraceae	Magnoliophyta

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Lamium purpureum L. var. *purpureum*	purple deadnettle*	Lamiaceae	Magnoliophyta
Laportea canadensis (L.) Weddell	Canadian woodnettle	Urticaceae	Magnoliophyta
Lasallia papulosa (Ach.) Llano	blistered naval lichen	Umbilicariaceae	Ascomycota
Lasallia pensylvanica (Hoffm.) Llano	Pensylvania blistered naval lichen	Umbilicariaceae	Ascomycota
Leersia oryzoides (L.) Sw.	rice cutgrass	Poaceae	Magnoliophyta
Leersia Sw.	cutgrass	Poaceae	Magnoliophyta
Leersia virginica Willd.	whitegrass	Poaceae	Magnoliophyta
Lepraria caesiella R.C. Harris	dust lichen	Uncertain Lichen Family	Ascomycota
Lepraria lobificans Nyl.	dust lichen	Uncertain Lichen Family	Ascomycota
Lepraria neglecta (Nyl.) Erichsen	dust lichen	Uncertain Lichen Family	Ascomycota
Lepraria obscura Lendemer	dust lichen	Uncertain Lichen Family	Ascomycota
Lespedeza cuneata (Dum.-Cours.) G. Don	Chinese lespedeza*	Fabaceae	Magnoliophyta
Lespedeza frutescens (L.) Hornem.	shrubby lespedeza	Fabaceae	Magnoliophyta
Lespedeza Michx.	lespedeza	Fabaceae	Magnoliophyta
Lespedeza procumbens Michx.	trailing lespedeza	Fabaceae	Magnoliophyta
Lespedeza repens (L.) W. Bart.	creeping lespedeza	Fabaceae	Magnoliophyta
Leucanthemum vulgare Lam.	oxeye daisy*	Asteraceae	Magnoliophyta
Leucobryum albidum (Brid. ex P. Beauv.) Lindb.	leucobryum moss	Leucobryaceae	Bryophyta
Leucobryum glaucum (Hedw.) Ångstr. in Fries	leucobryum moss	Leucobryaceae	Bryophyta
Leucobryum Hampe	leucobryum moss	Leucobryaceae	Bryophyta
Leucolejeunea clypeata (Schwein.) A. Evans	white caveleaf liverwort	Lejeuneaceae	Marchantiophyta
Liatris scariosa (L.) Willd.	devil's bite	Asteraceae	Magnoliophyta
Lichenothelia D. Hawksw.	lichenothelia lichen	Lichenotheliaceae	Ascomycota
Lilium canadense L.	Canada lily	Liliaceae	Magnoliophyta
Lilium superbum L.	turk's-cap lily	Liliaceae	Magnoliophyta
Lindera benzoin (L.) Blume	northern spicebush	Lauraceae	Magnoliophyta
Lindera benzoin (L.) Blume var. *benzoin*	northern spicebush	Lauraceae	Magnoliophyta
Lindera benzoin (L.) Blume var. *pubescens* (Palmer & Steyermark) Rehd.	northern spicebush	Lauraceae	Magnoliophyta
Lindernia dubia (L.) Pennell var. *dubia*	yellowseed false pimpernel	Scrophulariaceae	Magnoliophyta
Linum striatum Walt.	ridged yellow flax	Linaceae	Magnoliophyta
Linum virginianum L.	woodland flax	Linaceae	Magnoliophyta
Liquidambar styraciflua L.	sweetgum	Hamamelidaceae	Magnoliophyta
Liriodendron tulipifera L.	tuliptree	Magnoliaceae	Magnoliophyta
Lobelia cardinalis L.	cardinalflower	Campanulaceae	Magnoliophyta
Lobelia inflata L.	Indian-tobacco	Campanulaceae	Magnoliophyta
Lobelia L.	lobelia	Campanulaceae	Magnoliophyta
Loeskeobryum brevirostre (Brid.) Fleisch. in Broth.	loeskeobryum moss	Hylocomiaceae	Bryophyta
Lolium arundinaceum (Schreb.) S.J. Darbyshire	tall fescue*	Poaceae	Magnoliophyta
Lolium pratense (Huds.) S.J. Darbyshire	meadow ryegrass*	Poaceae	Magnoliophyta
Lonicera japonica Thunb.	Japanese honeysuckle*	Caprifoliaceae	Magnoliophyta
Lonicera morrowii Gray	Morrow's honeysuckle	Caprifoliaceae	Magnoliophyta
Lophocolea heterophylla (Schrad.) Dumort.	variable malepouch liverwort	Lophocoleaceae	Marchantiophyta

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Ludwigia palustris (L.) Ell.	marsh seedbox	Onagraceae	Magnoliophyta
Luzula acuminata Raf.	hairy woodrush	Juncaceae	Magnoliophyta
Luzula DC.	woodrush	Juncaceae	Magnoliophyta
Luzula echinata (Small) F.J. Herm.	hedgehog woodrush	Juncaceae	Magnoliophyta
Luzula multiflora (Ehrh.) Lej. ssp. *multiflora* var. *multiflora*	common woodrush	Juncaceae	Magnoliophyta
Lycopodium digitatum Dill. ex A. Braun	fan clubmoss	Lycopodiaceae	Lycopodiophyta
Lycopodium tristachyum Pursh	deeproot clubmoss	Lycopodiaceae	Lycopodiophyta
Lycopus L.	waterhorehound	Lamiaceae	Magnoliophyta
Lycopus uniflorus Michx. var. *uniflorus*	northern bugleweed	Lamiaceae	Magnoliophyta
Lycopus virginicus L.	Virginia water horehound	Lamiaceae	Magnoliophyta
Lyonia ligustrina (L.) DC. var. *ligustrina*	maleberry	Ericaceae	Magnoliophyta
Lysimachia ciliata L.	fringed loosestrife	Primulaceae	Magnoliophyta
Lysimachia lanceolata Walt.	lanceleaf loosestrife	Primulaceae	Magnoliophyta
Lysimachia nummularia L.	creeping jenny*	Primulaceae	Magnoliophyta
Lysimachia quadrifolia L.	whorled yellow loosestrife	Primulaceae	Magnoliophyta
Lysimachia terrestris (L.) B.S.P.	earth loosestrife	Primulaceae	Magnoliophyta
Magnolia acuminata (L.) L.	cucumber-tree	Magnoliaceae	Magnoliophyta
Magnolia fraseri Walt.	mountain magnolia	Magnoliaceae	Magnoliophyta
Magnolia tripetala (L.) L.	umbrella-tree	Magnoliaceae	Magnoliophyta
Maianthemum canadense Desf.	Canada mayflower	Liliaceae	Magnoliophyta
Maianthemum racemosum (L.) Link ssp. *racemosum*	feathery false lily of the valley	Liliaceae	Magnoliophyta
Marshallia grandiflora Beadle & F.E. Boynt.	Monongahela Barbara's buttons	Asteraceae	Magnoliophyta
Medeola virginiana L.	Indian cucumber	Liliaceae	Magnoliophyta
Meehania cordata (Nutt.) Britt.	Meehan's mint	Lamiaceae	Magnoliophyta
Menispermum canadense L.	common moonseed	Menispermaceae	Magnoliophyta
Microstegium vimineum (Trin.) A. Camus	Nepalese browntop*	Poaceae	Magnoliophyta
Mimulus alatus Ait.	sharpwing monkeyflower	Scrophulariaceae	Magnoliophyta
Mimulus ringens L. var. *ringens*	Allegheny monkeyflower	Scrophulariaceae	Magnoliophyta
Mitchella repens L.	partridgeberry	Rubiaceae	Magnoliophyta
Mitella diphylla L.	twoleaf miterwort	Saxifragaceae	Magnoliophyta
Mnium Hedw.	mnium calcareous moss	Mniaceae	Bryophyta
Mnium hornum Hedw.	horn calcareous moss	Mniaceae	Bryophyta
Monarda clinopodia L.	white bergamot	Lamiaceae	Magnoliophyta
Monarda L.	beebalm	Lamiaceae	Magnoliophyta
Monotropa hypopithys L.	pinesap	Monotropaceae	Magnoliophyta
Monotropa uniflora L.	Indianpipe	Monotropaceae	Magnoliophyta
Morus rubra L. var. *rubra*	red mulberry	Moraceae	Magnoliophyta
Muhlenbergia frondosa (Poir.) Fern.	wirestem muhly	Poaceae	Magnoliophyta
Muhlenbergia Schreb.	muhly	Poaceae	Magnoliophyta
Muhlenbergia schreberi J.F. Gmel.	nimblewill	Poaceae	Magnoliophyta
Muhlenbergia sylvatica Torr. ex Gray	woodland muhly	Poaceae	Magnoliophyta
Muhlenbergia tenuiflora (Willd.) B.S.P.	slender muhly	Poaceae	Magnoliophyta
Mutinus elegans (Mont.) E. Fischer	elegant stinkhorn	Phallaceae	Basidiomycota
Myelochroa aurulenta (Tuck.) Elix & Hale	myelochroa lichen	Parmeliaceae	Ascomycota
Nowellia curvifolia (Dicks.) Mitt.	red crescent liverwort	Cephaloziaceae	Marchantiophyta
Nyssa sylvatica Marsh.	blackgum	Cornaceae	Magnoliophyta
Oenothera L.	evening-primrose	Onagraceae	Magnoliophyta
Onoclea sensibilis L.	sensitive fern	Dryopteridaceae	Polypodiophyta
Osmorhiza claytonii (Michx.) C.B. Clarke	Clayton's sweetroot	Apiaceae	Magnoliophyta
Osmunda cinnamomea L.	cinnamon fern	Osmundaceae	Polypodiophyta

Scientific Name	**Common Name**	**Family**	**Division**
Osmunda claytoniana L.	interrupted fern	Osmundaceae	Polypodiophyta
Osmunda regalis L. var. *spectabilis* (Willd.) Gray	royal fern	Osmundaceae	Polypodiophyta
Ostrya virginiana (P. Mill.) K. Koch var. *virginiana*	hophornbeam	Betulaceae	Magnoliophyta
Oxalis dillenii Jacq.	slender yellow wood sorrel	Oxalidaceae	Magnoliophyta
Oxalis grandis Small	great yellow woodsorrel	Oxalidaceae	Magnoliophyta
Oxalis L.	woodsorrel	Oxalidaceae	Magnoliophyta
Oxalis stricta L.	common yellow oxalis	Oxalidaceae	Magnoliophyta
Oxalis violacea L.	violet woodsorrel	Oxalidaceae	Magnoliophyta
Oxydendrum arboreum (L.) DC.	sourwood	Ericaceae	Magnoliophyta
Oxypolis rigidior (L.) Raf.	stiff cowbane	Apiaceae	Magnoliophyta
Packera aurea (L.) A.& D. Löve	golden ragwort	Asteraceae	Magnoliophyta
Packera obovata (Muhl. ex Willd.) W.A. Weber & A. Löve	roundleaf ragwort	Asteraceae	Magnoliophyta
Packera paupercula (Michx.) A. & D. Löve	balsam groundsel	Asteraceae	Magnoliophyta
Panax quinquefolius L.	American ginseng	Araliaceae	Magnoliophyta
Panicum dichotomiflorum Michx. ssp. *dichotomiflorum*	fall panicgrass	Poaceae	Magnoliophyta
Panicum L.	panicgrass	Poaceae	Magnoliophyta
Panicum virgatum L.	switchgrass	Poaceae	Magnoliophyta
Parmelia Ach.	shield lichen	Parmeliaceae	Ascomycota
Parmotrema hypotropum (Nyl.) Hale	lichen	Parmeliaceae	Ascomycota
Paronychia canadensis (L.) Wood	smooth forked nailwort	Caryophyllaceae	Magnoliophyta
Parthenocissus quinquefolia (L.) Planch.	Virginia creeper	Vitaceae	Magnoliophyta
Passiflora lutea L.	yellow passionflower	Passifloraceae	Magnoliophyta
Paulownia tomentosa (Thunb.) Sieb. & Zucc. ex Steud.	princesstree*	Scrophulariaceae	Magnoliophyta
Pedicularis canadensis L. ssp. *canadensis*	Canadian lousewort	Scrophulariaceae	Magnoliophyta
Pellia epiphylla (L.) Corda	flap wing liverwort	Pelliaceae	Marchantiophyta
Penthorum sedoides L.	ditch stonecrop	Crassulaceae	Magnoliophyta
Phaeocalicium polyporaeum (Nyl.) Tibell	phaeocalicium fungus	Mycocalicialeae	Ascomycota
Phegopteris hexagonoptera (Michx.) Fée	broad beechfern	Thelypteridaceae	Polypodiophyta
Phlox L.	phlox	Polemoniaceae	Magnoliophyta
Phlox maculata L.	wild sweetwilliam	Polemoniaceae	Magnoliophyta
Phlox maculata L. ssp. *maculata*	wild sweetwilliam	Polemoniaceae	Magnoliophyta
Phlox maculata L. ssp. *pyramidalis* (Sm.) Wherry	wild sweetwilliam	Polemoniaceae	Magnoliophyta
Phlox paniculata L.	fall phlox	Polemoniaceae	Magnoliophyta
Phlyctis petraea auct. R.C. Harris	lichen	Phlyctidaceae	Ascomycota
Phryma leptostachya L.	American lopseed	Verbenaceae	Magnoliophyta
Physocarpus opulifolius (L.) Maxim. var. *opulifolius*	common ninebark	Rosaceae	Magnoliophyta
Physostegia virginiana (L.) Benth. ssp. *virginiana*	obedient plant	Lamiaceae	Magnoliophyta
Phytolacca americana L. var. *americana*	American pokeweed	Phytolaccaceae	Magnoliophyta
Pilea pumila (L.) Gray var. *pumila*	Canadian clearweed	Urticaceae	Magnoliophyta
Pinus L.	pine	Pinaceae	Pinophyta
Pinus rigida P. Mill.	pitch pine	Pinaceae	Pinophyta
Pinus strobus L.	eastern white pine	Pinaceae	Pinophyta
Pinus virginiana P. Mill.	Virginia pine	Pinaceae	Pinophyta
Plagiomnium ciliare (C. Müll.) T. Kop.	plagiomnium moss	Mniaceae	Bryophyta
Plagiomnium cuspidatum (Hedw.) T. Kop.	toothed plagiomnium moss	Mniaceae	Bryophyta

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Plagiomnium ellipticum (Brid.) T. Kop.	elliptic plagiomnium moss	Mniaceae	Bryophyta
Plantago rugelii Dcne. var. *rugelii*	blackseed plantain	Plantaginaceae	Magnoliophyta
Platanthera clavellata (Michx.) Luer	small green wood orchid	Orchidaceae	Magnoliophyta
Platanthera L.C. Rich.	fringed orchid	Orchidaceae	Magnoliophyta
Platanus occidentalis L.	American sycamore	Platanaceae	Magnoliophyta
Platismatia tuckermanii (Oakes) W.L. Culb. & C.F. Culb.	Tuckerman's ragged lichen	Parmeliaceae	Ascomycota
Poa alsodes Gray	grove bluegrass	Poaceae	Magnoliophyta
Poa compressa L.	Canada bluegrass*	Poaceae	Magnoliophyta
Poa cuspidata Nutt.	early bluegrass	Poaceae	Magnoliophyta
Poa L.	bluegrass	Poaceae	Magnoliophyta
Poa sylvestris Gray	woodland bluegrass	Poaceae	Magnoliophyta
Podophyllum peltatum L.	mayapple	Berberidaceae	Magnoliophyta
Polygala polygama Walt.	racemed milkwort	Polygalaceae	Magnoliophyta
Polygala senega L.	Seneca snakeroot	Polygalaceae	Magnoliophyta
Polygonatum biflorum (Walt.) Ell.	smooth Solomon's seal	Liliaceae	Magnoliophyta
Polygonatum pubescens (Willd.) Pursh	hairy Solomon's seal	Liliaceae	Magnoliophyta
Polygonum caespitosum Blume var. *longisetum* (de Bruyn) A.N. Steward	oriental ladysthumb*	Polygonaceae	Magnoliophyta
Polygonum convolvulus L. var. *convolvulus*	black bindweed*	Polygonaceae	Magnoliophyta
Polygonum cuspidatum Sieb. & Zucc.	Japanese knotweed*	Polygonaceae	Magnoliophyta
Polygonum hydropiperoides Michx.	swamp smartweed	Polygonaceae	Magnoliophyta
Polygonum L.	knotweed	Polygonaceae	Magnoliophyta
Polygonum scandens L.	climbing false buckwheat	Polygonaceae	Magnoliophyta
Polygonum virginianum L.	jumpseed	Polygonaceae	Magnoliophyta
Polymnia canadensis L.	whiteflower leafcup	Asteraceae	Magnoliophyta
Polypodium virginianum L.	rock polypody	Polypodiaceae	Polypodiophyta
Polystichum acrostichoides (Michx.) Schott	Christmas fern	Dryopteridaceae	Polypodiophyta
Polytrichum commune Hedw.	polytrichum moss	Polytrichaceae	Bryophyta
Polytrichum Hedw.	polytrichum moss	Polytrichaceae	Bryophyta
Polytrichum juniperinum Hedw.	juniper polytrichum moss	Polytrichaceae	Bryophyta
Polytrichum ohioense Ren. & Card.	Ohio polytrichum moss	Polytrichaceae	Bryophyta
Polytrichum pallidisetum Funck	polytrichum moss	Polytrichaceae	Bryophyta
Populus grandidentata Michx.	bigtooth aspen	Salicaceae	Magnoliophyta
Porella pinnata L.	aquatic tongue liverwort	Porellaceae	Marchantiophyta
Porpidia albocaerulescens (Wulfen) Hertel & Knoph	Porpidia lichen	Porpidiaceae	Ascomycota
Porteranthus trifoliatus (L.) Britt.	Bowman's root	Rosaceae	Magnoliophyta
Potentilla canadensis L. var. *canadensis*	dwarf cinquefoil	Rosaceae	Magnoliophyta
Potentilla L.	cinquefoil	Rosaceae	Magnoliophyta
Potentilla simplex Michx.	common cinquefoil	Rosaceae	Magnoliophyta
Prenanthes alba L.	white rattlesnakeroot	Asteraceae	Magnoliophyta
Prenanthes L.	rattlesnakeroot	Asteraceae	Magnoliophyta
Prosartes lanuginosa (Michx.) D. Don	yellow fairybells	Liliaceae	Magnoliophyta
Prunella vulgaris L.	common selfheal*	Lamiaceae	Magnoliophyta
Prunus L.	plum	Rosaceae	Magnoliophyta
Prunus pensylvanica L. f. var. *pensylvanica*	pin cherry	Rosaceae	Magnoliophyta
Prunus pumila L. var. *depressa* (Pursh) Gleason	eastern sandcherry	Rosaceae	Magnoliophyta
Prunus serotina Ehrh. var. *serotina*	black cherry	Rosaceae	Magnoliophyta
Pteridium aquilinum (L.) Kuhn	western brackenfern	Dennstaedtiaceae	Polypodiophyta
Pteridium aquilinum (L.) Kuhn var. *latiusculum* (Desv.) Underwood ex Heller	western brackenfern	Dennstaedtiaceae	Polypodiophyta

Scientific Name	Common Name	Family	Division
Punctelia rudecta (Ach.) Krog	lichen	Parmeliaceae	Ascomycota
Pylaisiadelpha tenuirostris (Bruch & Schimp. ex Sull.) Buck	pylaisiadelpha moss	Hypnaceae	Bryophyta
Pyrularia pubera Michx.	buffalo nut	Santalaceae	Magnoliophyta
Quercus alba L.	white oak	Fagaceae	Magnoliophyta
Quercus coccinea Muenchh. var. *coccinea*	scarlet oak	Fagaceae	Magnoliophyta
Quercus L.	oak	Fagaceae	Magnoliophyta
Quercus muehlenbergii Engelm.	chinkapin oak	Fagaceae	Magnoliophyta
Quercus palustris Muenchh.	pin oak	Fagaceae	Magnoliophyta
Quercus prinus L.	chestnut oak	Fagaceae	Magnoliophyta
Quercus rubra L.	northern red oak	Fagaceae	Magnoliophyta
Quercus stellata Wangenh.	post oak	Fagaceae	Magnoliophyta
Quercus velutina Lam.	black oak	Fagaceae	Magnoliophyta
Racomitrium aciculare (Hedw.) Brid.	racomitrium moss	Grimmiaceae	Bryophyta
Ranunculus abortivus L.	littleleaf buttercup	Ranunculaceae	Magnoliophyta
Ranunculus allegheniensis Britt.	Allegheny Mountain buttercup	Ranunculaceae	Magnoliophyta
Ranunculus hispidus Michx. var. *hispidus*	bristly buttercup	Ranunculaceae	Magnoliophyta
Ranunculus hispidus Michx. var. *nitidus* (Chapman) T. Duncan	bristly buttercup	Ranunculaceae	Magnoliophyta
Ranunculus L.	buttercup	Ranunculaceae	Magnoliophyta
Ranunculus recurvatus Poir. var. *recurvatus*	blisterwort	Ranunculaceae	Magnoliophyta
Rhabdoweisia crispata (With.) Lindb.	rhabdoweisia moss	Dicranaceae	Bryophyta
Rhodobryum ontariense (Kindb.) Par. in Kindb.	Ontario rhodobryum moss	Bryaceae	Bryophyta
Rhododendron arborescens (Pursh) Torr.	smooth azalea	Ericaceae	Magnoliophyta
Rhododendron calendulaceum (Michx.) Torr.	flame azalea	Ericaceae	Magnoliophyta
Rhododendron catawbiense Michx.	Catawba rosebay	Ericaceae	Magnoliophyta
Rhododendron L.	rhododendron	Ericaceae	Magnoliophyta
Rhododendron maximum L.	great laurel	Ericaceae	Magnoliophyta
Rhododendron periclymenoides (Michx.) Shinners	pink azalea	Ericaceae	Magnoliophyta
Rhus copallinum L.	flameleaf sumac	Anacardiaceae	Magnoliophyta
Rhus L.	sumac	Anacardiaceae	Magnoliophyta
Rhynchospora capitellata (Michx.) Vahl	brownish beaksedge	Cyperaceae	Magnoliophyta
Ribes cynosbati L.	eastern prickly gooseberry	Grossulariaceae	Magnoliophyta
Ribes L.	currant	Grossulariaceae	Magnoliophyta
Robinia pseudoacacia L.	black locust	Fabaceae	Magnoliophyta
Rorippa palustris (L.) Bess. ssp. *palustris*	bog yellowcress	Brassicaceae	Magnoliophyta
Rosa carolina L. var. *carolina*	Carolina rose	Rosaceae	Magnoliophyta
Rosa multiflora Thunb. ex Murr.	multiflora rose*	Rosaceae	Magnoliophyta
Rubus allegheniensis Porter	Allegheny blackberry	Rosaceae	Magnoliophyta
Rubus flagellaris Willd.	northern dewberry	Rosaceae	Magnoliophyta
Rubus L.	blackberry	Rosaceae	Magnoliophyta
Rubus occidentalis L.	black raspberry	Rosaceae	Magnoliophyta
Rubus odoratus L. var. *odoratus*	purpleflowering raspberry	Rosaceae	Magnoliophyta
Rubus phoenicolasius Maxim.	wine raspberry*	Rosaceae	Magnoliophyta
Rudbeckia laciniata L. var. *laciniata*	cutleaf coneflower	Asteraceae	Magnoliophyta
Rumex crispus L. ssp. *crispus*	curly dock*	Polygonaceae	Magnoliophyta
Russula	russula mushroom	Russulaceae	Basidiomycota
Sagittaria latifolia Willd.	broadleaf arrowhead	Alismataceae	Magnoliophyta
Salix alba L.	white willow*	Salicaceae	Magnoliophyta
Salix caroliniana Michx.	coastal plain willow	Salicaceae	Magnoliophyta

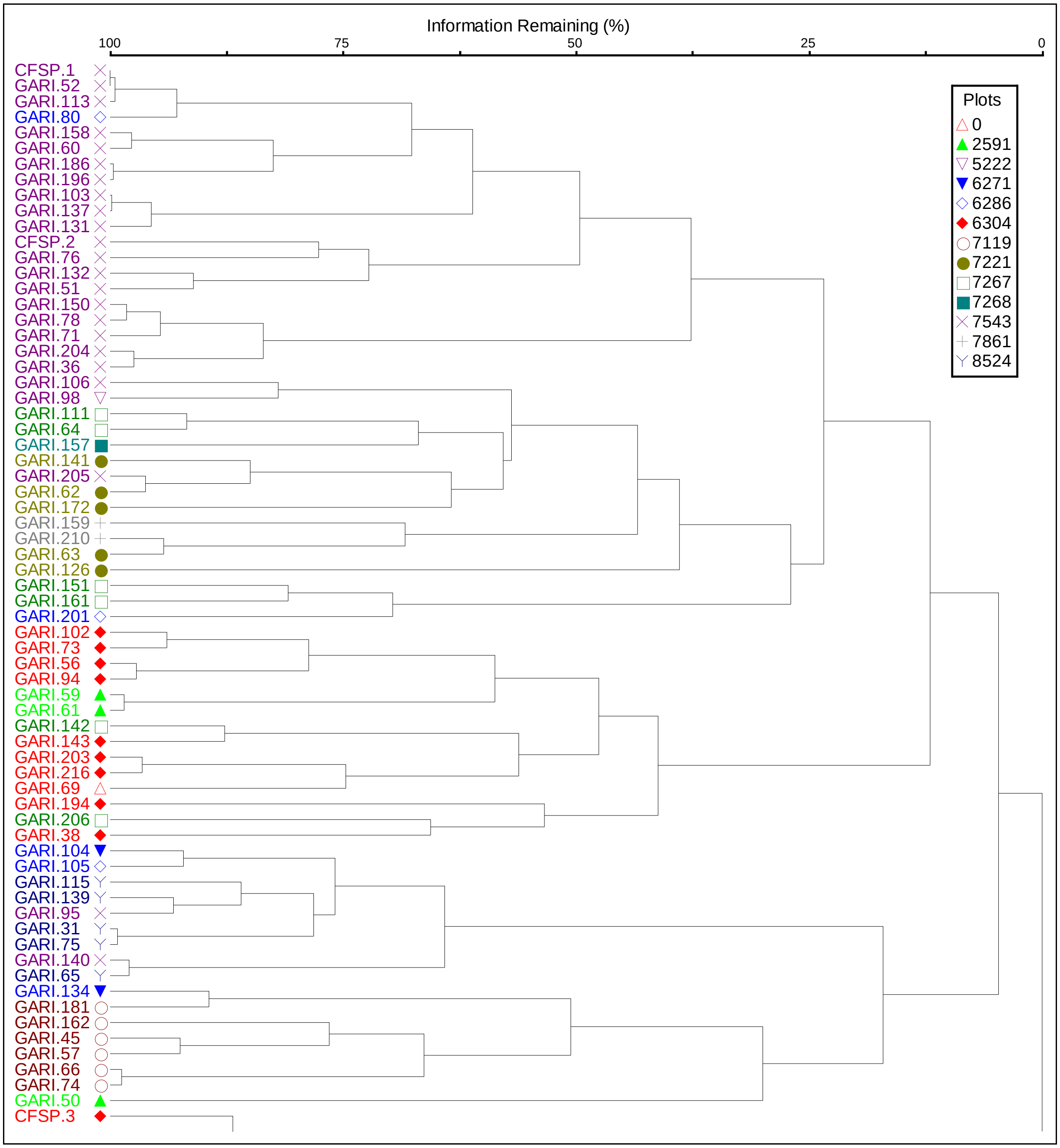
Scientific Name	Common Name	Family	Division
Salix fragilis L.	crack willow*	Salicaceae	Magnoliophyta
Salix nigra Marsh.	black willow	Salicaceae	Magnoliophyta
Salix sericea Marsh.	silky willow	Salicaceae	Magnoliophyta
Salvia lyrata L.	lyreleaf sage	Lamiaceae	Magnoliophyta
Sambucus L.	elderberry	Caprifoliaceae	Magnoliophyta
Sambucus nigra L. ssp. *canadensis* (L.) R. Bolli	common elderberry	Caprifoliaceae	Magnoliophyta
Sambucus racemosa L. var. *racemosa*	red elderberry	Caprifoliaceae	Magnoliophyta
Sanguinaria canadensis L.	bloodroot	Papaveraceae	Magnoliophyta
Sanicula canadensis L.	Canadian blacksnakeroot	Apiaceae	Magnoliophyta
Sanicula canadensis L. var. *grandis* Fern.	Canadian blacksnakeroot	Apiaceae	Magnoliophyta
Sanicula L.	sanicle	Apiaceae	Magnoliophyta
Sanicula marilandica L.	Maryland sanicle	Apiaceae	Magnoliophyta
Sanicula trifoliata Bickn.	largefruit blacksnakeroot	Apiaceae	Magnoliophyta
Sassafras albidum (Nutt.) Nees	sassafras	Lauraceae	Magnoliophyta
Scapania nemorea (L.) Grolle	toothy mitten liverwort	Scapaniaceae	Marchantiophyta
Schistidium apocarpum (Hedw.) Bruch & Schimp. in B.S.G.	schistidium moss	Grimmiaceae	Bryophyta
Schizachyrium scoparium (Michx.) Nash var. *scoparium*	little bluestem	Poaceae	Magnoliophyta
Schoenoplectus tabernaemontani (K.C. Gmel.) Palla	softstem bulrush	Cyperaceae	Magnoliophyta
Scirpus atrovirens Willd.	green bulrush	Cyperaceae	Magnoliophyta
Scirpus cyperinus (L.) Kunth	woolgrass	Cyperaceae	Magnoliophyta
Scirpus L.	bulrush	Cyperaceae	Magnoliophyta
Scirpus polyphyllus Vahl	leafy bulrush	Cyperaceae	Magnoliophyta
Scutellaria elliptica Muhl. ex Spreng. var. *hirsuta* (Short & Peter) Fern.	hairy skullcap	Lamiaceae	Magnoliophyta
Scutellaria lateriflora L. var. *lateriflora*	mad-dog skullcap	Lamiaceae	Magnoliophyta
Sedum ternatum Michx.	woodland stonecrop	Crassulaceae	Magnoliophyta
Sematophyllum demissum (Wils.) Mitt.	sematophyllum moss	Sematophyllaceae	Bryophyta
Sericocarpus asteroides (L.) B.S.P.	toothed whitetop aster	Asteraceae	Magnoliophyta
Silene L.	catchfly	Caryophyllaceae	Magnoliophyta
Silene stellata (L.) Ait. f.	widowsfrill	Caryophyllaceae	Magnoliophyta
Silene virginica L. var. *virginica*	fire pink	Caryophyllaceae	Magnoliophyta
Sisyrinchium angustifolium P. Mill.	narrowleaf blue-eyed grass	Iridaceae	Magnoliophyta
Smilax ecirrata (Engelm. ex Kunth) S. Wats.	upright carrionflower	Smilacaceae	Magnoliophyta
Smilax glauca Walt.	cat greenbrier	Smilacaceae	Magnoliophyta
Smilax herbacea L.	smooth carrionflower	Smilacaceae	Magnoliophyta
Smilax L.	greenbrier	Smilacaceae	Magnoliophyta
Smilax rotundifolia L.	roundleaf greenbrier	Smilacaceae	Magnoliophyta
Smilax tamnoides L.	bristly greenbrier	Smilacaceae	Magnoliophyta
Solanum carolinense L. var. *carolinense*	Carolina horsenettle	Solanaceae	Magnoliophyta
Solidago arguta Ait.	Atlantic goldenrod	Asteraceae	Magnoliophyta
Solidago arguta Ait. var. arguta	Atlantic goldenrod	Asteraceae	Magnoliophyta
Solidago bicolor L.	white goldenrod	Asteraceae	Magnoliophyta
Solidago caesia L.	wreath goldenrod	Asteraceae	Magnoliophyta
Solidago curtisii Torr. & Gray	Curtis' goldenrod	Asteraceae	Magnoliophyta
Solidago flexicaulis L.	zigzag goldenrod	Asteraceae	Magnoliophyta
Solidago gigantea Ait.	giant goldenrod	Asteraceae	Magnoliophyta
Solidago hispida Muhl. ex Willd. var. *hispida*	hairy goldenrod	Asteraceae	Magnoliophyta

Scientific Name	Common Name	Family	Division
Solidago juncea Ait. var. *juncea*	early goldenrod	Asteraceae	Magnoliophyta
Solidago L.	goldenrod	Asteraceae	Magnoliophyta
Solidago roanensis Porter	Roan Mountain goldenrod	Asteraceae	Magnoliophyta
Solidago rugosa P. Mill.	wrinkleleaf goldenrod	Asteraceae	Magnoliophyta
Solidago simplex Kunth ssp. *randii* (Porter) Ringius var. *racemosa* (Greene) Ringius	Rand's goldenrod	Asteraceae	Magnoliophyta
Sorghastrum nutans (L.) Nash	Indiangrass	Poaceae	Magnoliophyta
Sparganium chlorocarpum Rydb.	burreed	Sparganiaceae	Magnoliophyta
Sphagnum capillifolium var. *capillifolium* (Ehrh.) Hedw.	pompom hair peatmoss	Sphagnaceae	Bryophyta
Sphagnum lescurii Sull. in Gray	Lescur's sphagnum	Sphagnaceae	Bryophyta
Sphagnum palustre L.	prairie sphagnum	Sphagnaceae	Bryophyta
Sphenopholis nitida (Biehler) Scribn.	shiny wedgescale	Poaceae	Magnoliophyta
Spiraea alba Du Roi var. *alba*	white meadowsweet	Rosaceae	Magnoliophyta
Spiraea virginiana Britt.	Virginia meadowsweet	Rosaceae	Magnoliophyta
Staphylea trifolia L.	American bladdernut	Staphyleaceae	Magnoliophyta
Steerecleus serrulatus (Hedw.) Robins.	steerecleus moss	Brachytheciaceae	Bryophyta
Stellaria media (L.) Vill. ssp. *pallida* (Dumort.) Aschers. & Graebn.	common chickweed*	Caryophyllaceae	Magnoliophyta
Stellaria pubera Michx.	star chickweed	Caryophyllaceae	Magnoliophyta
Streptopus lanceolatus (Ait.) Reveal var. *roseus* (Michx.) Reveal	twistedstalk	Liliaceae	Magnoliophyta
Stylophorum diphyllum (Michx.) Nutt.	celandine poppy	Papaveraceae	Magnoliophyta
Symphyotrichum cordifolium (L.) Nesom	common blue wood aster	Asteraceae	Magnoliophyta
Symphyotrichum dumosum (L.) Nesom var. *dumosum*	rice button aster	Asteraceae	Magnoliophyta
Symphyotrichum laeve (L.) A.& D. Löve var. *concinnum* (Willd.) Nesom	smooth blue aster	Asteraceae	Magnoliophyta
Symphyotrichum lanceolatum (Willd.) Nesom	white panicle aster	Asteraceae	Magnoliophyta
Symphyotrichum lateriflorum (L.) A.& D. Löve	calico aster	Asteraceae	Magnoliophyta
Symphyotrichum Nees	aster	Asteraceae	Magnoliophyta
Symphyotrichum patens (Ait.) Nesom var. *patens*	late purple aster	Asteraceae	Magnoliophyta
Symphyotrichum pilosum (Willd.) Nesom	hairy white oldfield aster	Asteraceae	Magnoliophyta
Symphyotrichum praealtum (Poir.) Nesom	willowleaf aster	Asteraceae	Magnoliophyta
Symphyotrichum prenanthoides (Muhl. ex Willd.) Nesom	crookedstem aster	Asteraceae	Magnoliophyta
Symphyotrichum puniceum (L.) A.& D. Löve var. *puniceum*	purplestem aster	Asteraceae	Magnoliophyta
Symphyotrichum racemosum (Ell.) Nesom	smooth white oldfield aster	Asteraceae	Magnoliophyta
Symphyotrichum undulatum (L.) Nesom	waxyleaf aster	Asteraceae	Magnoliophyta
Taenidia integerrima (L.) Drude	yellow pimpernel	Apiaceae	Magnoliophyta
Taraxacum officinale G.H. Weber ex Wiggers ssp. *officinale*	common dandelion*	Asteraceae	Magnoliophyta
Tephrosia virginiana (L.) Pers.	Virginia tephrosia	Fabaceae	Magnoliophyta
Tetraphis pellucida Hedw.	tetraphis moss	Tetraphidaceae	Bryophyta
Thalictrum clavatum DC.	mountain meadow-rue	Ranunculaceae	Magnoliophyta
Thalictrum L.	meadow-rue	Ranunculaceae	Magnoliophyta
Thalictrum pubescens Pursh	king of the meadow	Ranunculaceae	Magnoliophyta
Thalictrum revolutum DC.	waxyleaf meadow-rue	Ranunculaceae	Magnoliophyta

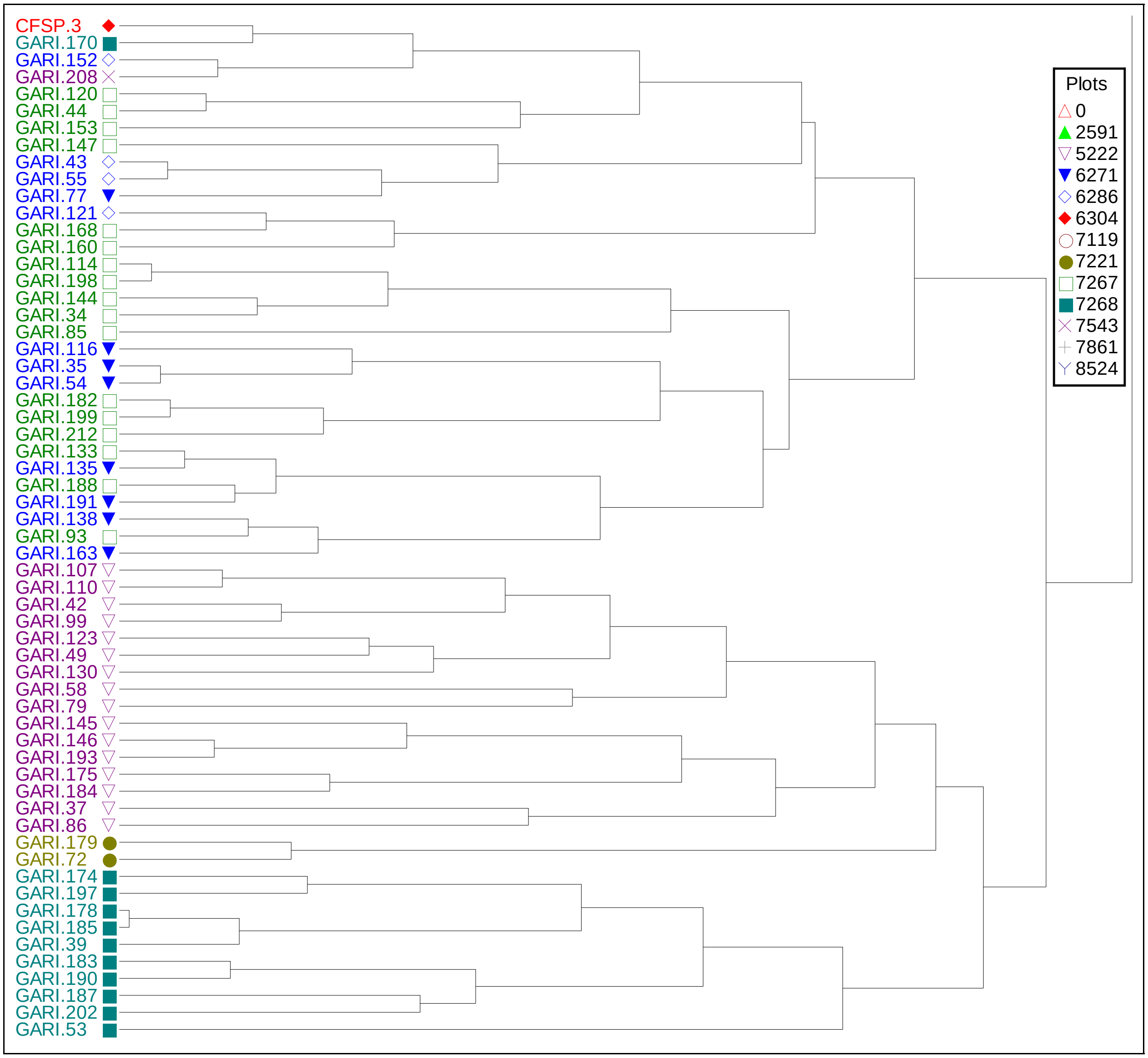
Scientific Name	**Common Name**	**Family**	**Division**
Thalictrum thalictroides (L.) Eames & Boivin	rue anemone	Ranunculaceae	Magnoliophyta
Thelypteris noveboracensis (L.) Nieuwl.	New York fern	Thelypteridaceae	Polypodiophyta
Thuidium delicatulum (Hedw.) Schimp. in B.S.G.	delicate thuidium moss	Thuidiaceae	Bryophyta
Thuidium Schimp. in B.S.G.	thuidium moss	Thuidiaceae	Bryophyta
Tiarella cordifolia L.	heartleaf foamflower	Saxifragaceae	Magnoliophyta
Tilia americana L.	American basswood	Tiliaceae	Magnoliophyta
Tilia americana L. var. *americana*	American basswood	Tiliaceae	Magnoliophyta
Tilia americana L. var. *heterophylla* (Vent.) Loud.	American basswood	Tiliaceae	Magnoliophyta
Toxicodendron radicans (L.) Kuntze	eastern poison ivy	Anacardiaceae	Magnoliophyta
Trautvetteria caroliniensis (Walt.) Vail var. *caroliniensis*	Carolina bugbane	Ranunculaceae	Magnoliophyta
Triadenum Raf.	marsh St. Johnswort	Clusiaceae	Magnoliophyta
Trichocolea tomentella (Ehrh.) Dumort.	woolly liverwort	Trichocoleaceae	Marchantiophyta
Trifolium L.	clover	Fabaceae	Magnoliophyta
Trifolium pratense L.	red clover*	Fabaceae	Magnoliophyta
Trillium erectum L.	red trillium	Liliaceae	Magnoliophyta
Trillium L.	trillium	Liliaceae	Magnoliophyta
Tsuga canadensis (L.) Carr.	eastern hemlock	Pinaceae	Pinophyta
Tuckermannopsis ciliaris (Ach.) Gyel.	tuckermannopsis lichen	Parmeliaceae	Ascomycota
Tussilago farfara L.	coltsfoot*	Asteraceae	Magnoliophyta
Ulmus americana L.	American elm	Ulmaceae	Magnoliophyta
Ulmus rubra Muhl.	slippery elm	Ulmaceae	Magnoliophyta
Ulota hutchinsiae (Sm.) Hammar	Hutchins' ulota moss	Orthotrichaceae	Bryophyta
Umbilicaria Hoffm.	navel lichen	Umbilicariaceae	Ascomycota
Umbilicaria mammulata (Ach.) Tuck.	navel lichen	Umbilicariaceae	Ascomycota
Usnea amblyoclada (Müll. Arg.) Zahlbr.	rock beard lichen	Parmeliaceae	Ascomycota
Uvularia grandiflora Sm.	largeflower bellwort	Liliaceae	Magnoliophyta
Uvularia L.	bellwort	Liliaceae	Magnoliophyta
Uvularia perfoliata L.	perfoliate bellwort	Liliaceae	Magnoliophyta
Uvularia puberula Michx.	mountain bellwort	Liliaceae	Magnoliophyta
Uvularia sessilifolia L.	sessileleaf bellwort	Liliaceae	Magnoliophyta
Vaccinium corymbosum L.	highbush blueberry	Ericaceae	Magnoliophyta
Vaccinium L.	blueberry	Ericaceae	Magnoliophyta
Vaccinium pallidum Ait.	Blue Ridge blueberry	Ericaceae	Magnoliophyta
Vaccinium stamineum L.	deerberry	Ericaceae	Magnoliophyta
Verbena urticifolia L.	white vervain	Verbenaceae	Magnoliophyta
Verbesina alternifolia (L.) Britt. ex Kearney	wingstem	Asteraceae	Magnoliophyta
Verbesina occidentalis (L.) Walt.	yellow crownbeard	Asteraceae	Magnoliophyta
Vernonia gigantea (Walt.) Trel. ssp. *gigantea*	giant ironweed	Asteraceae	Magnoliophyta
Vernonia Schreb.	ironweed	Asteraceae	Magnoliophyta
Veronica chamaedrys L.	germander speedwell*	Scrophulariaceae	Magnoliophyta
Viburnum acerifolium L.	mapleleaf viburnum	Caprifoliaceae	Magnoliophyta
Viburnum L.	viburnum	Caprifoliaceae	Magnoliophyta
Viburnum nudum L. var. *cassinoides* (L.) Torr. & Gray	withe-rod	Caprifoliaceae	Magnoliophyta
Viburnum prunifolium L.	blackhaw	Caprifoliaceae	Magnoliophyta
Viburnum recognitum Fern.	southern arrow-wood	Caprifoliaceae	Magnoliophyta
Viola ×palmata L.	palmate-leaved violet	Violaceae	Magnoliophyta
Viola ×primulifolia L. (pro sp.)	primrose-leaf violet	Violaceae	Magnoliophyta

Scientific Name	Common Name	Family	Division
Viola blanda Willd. var. *blanda*	sweet white violet	Violaceae	Magnoliophyta
Viola canadensis L.	Canadian white violet	Violaceae	Magnoliophyta
Viola cucullata Ait.	marsh blue violet	Violaceae	Magnoliophyta
Viola hastata Michx.	halberdleaf yellow violet	Violaceae	Magnoliophyta
Viola hirsutula Brainerd	southern woodland violet	Violaceae	Magnoliophyta
Viola L.	violet	Violaceae	Magnoliophyta
Viola pedata L.	birdfoot violet	Violaceae	Magnoliophyta
Viola pubescens Ait.	downy yellow violet	Violaceae	Magnoliophyta
Viola rostrata Pursh	longspur violet	Violaceae	Magnoliophyta
Viola rotundifolia Michx.	roundleaf yellow violet	Violaceae	Magnoliophyta
Viola sagittata Ait.	arrowleaf violet	Violaceae	Magnoliophyta
Viola sororia Willd.	common blue violet	Violaceae	Magnoliophyta
Viola striata Ait.	striped cream violet	Violaceae	Magnoliophyta
Viola triloba Schwein. var. *triloba*	three-lobed violet	Violaceae	Magnoliophyta
Vitis aestivalis Michx.	summer grape	Vitaceae	Magnoliophyta
Vitis L.	grape	Vitaceae	Magnoliophyta
Vitis riparia Michx.	riverbank grape	Vitaceae	Magnoliophyta
Xanthium strumarium L.	rough cockleburr	Asteraceae	Magnoliophyta
Xanthium strumarium L. var. *glabratum* (DC.) Cronq.	rough cockleburr	Asteraceae	Magnoliophyta
Xanthoparmelia conspersa (Ehrh. ex Ach.) Hale	xanthoparmelia lichen	Parmeliaceae	Ascomycota
Xanthoparmelia plittii (Gyelnk) Hale	Plitt's rock-shield lichen	Parmeliaceae	Ascomycota
Xanthorhiza simplicissima Marsh.	yellowroot	Ranunculaceae	Magnoliophyta
Xylaria hypoxylon (L.) Grev.	candlesnuff fungus	Xylariaceae	Ascomycota
Xylaria magnoliae J. D. Rogers	magnolia cone flickers	Xylariaceae	Ascomycota
Zizia aptera (Gray) Fern.	meadow zizia	Apiaceae	Magnoliophyta
Zizia trifoliata (Michx.) Fern.	meadow alexanders	Apiaceae	Magnoliophyta
Zizia W.D.J. Koch	zizia	Apiaceae	Magnoliophyta

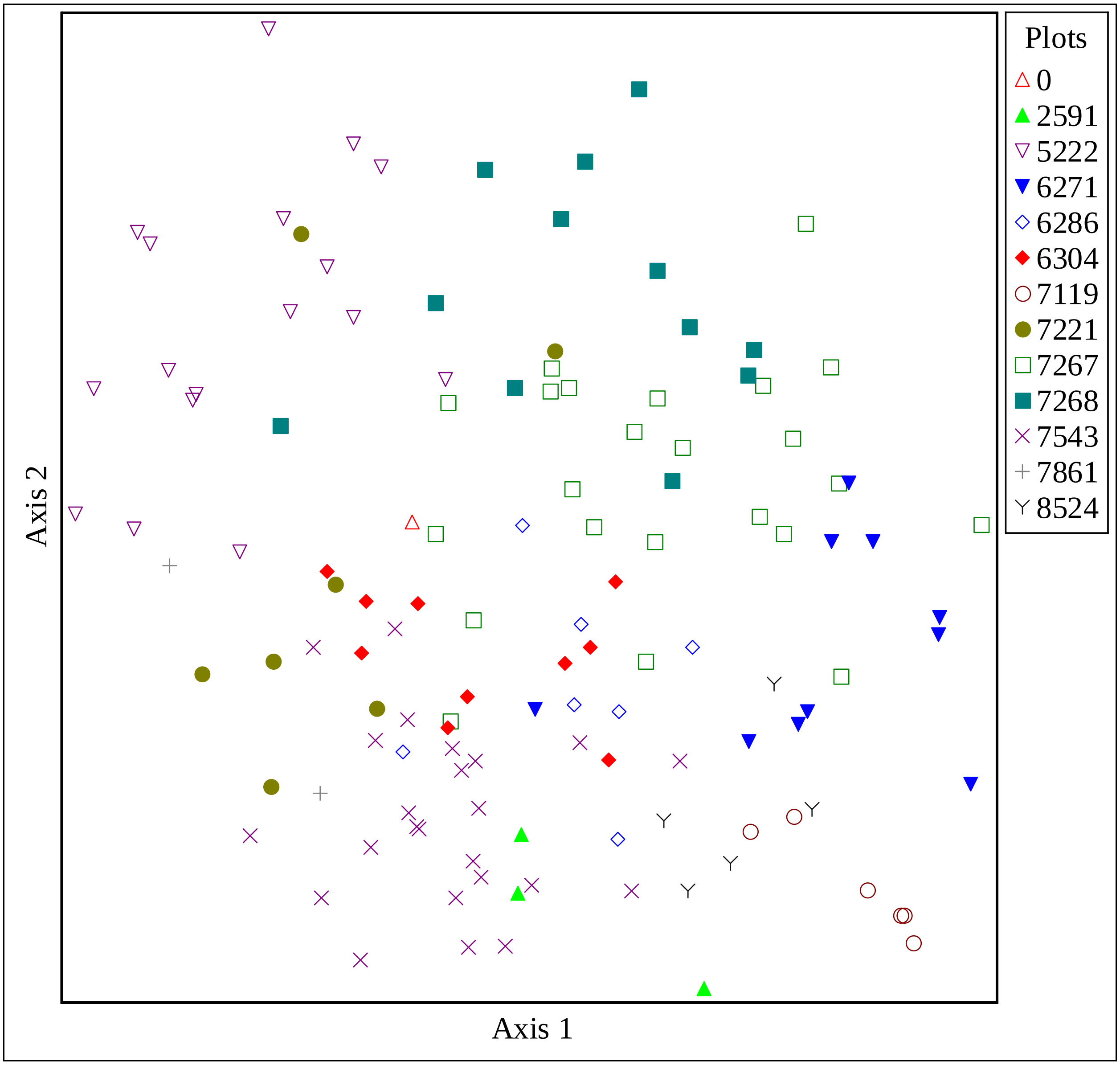
Appendix F. Cluster dendrograms and ordination graphs.



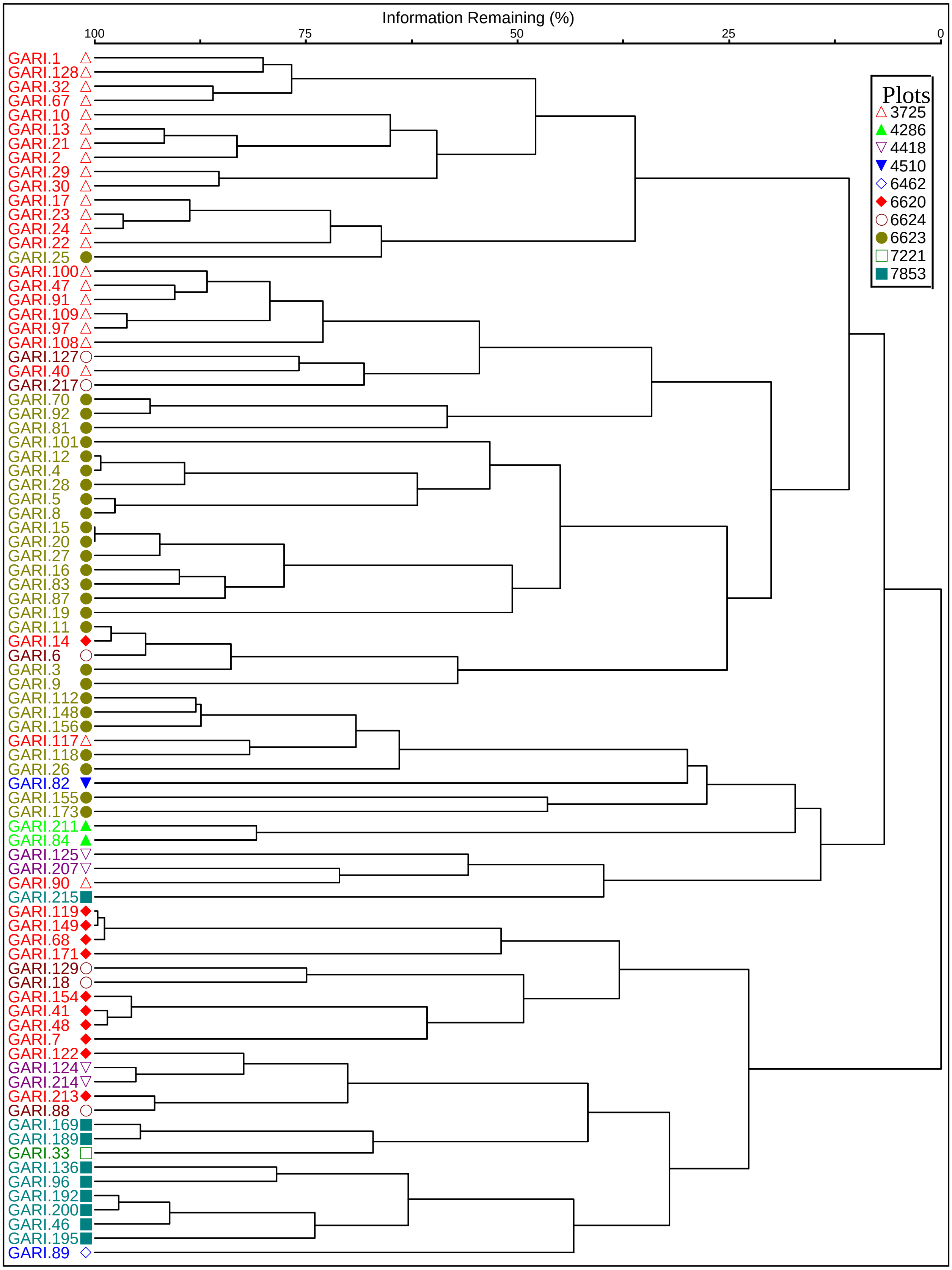
Dendrogram 1 (page 1 of 2). Hierarchical agglomerative cluster analysis of upland forests. Symbology indicates codes of associations in the U. S. National Vegetation Classification: 0 = unclassified plot, 2591 = Successional Virginia Pine Forest, 5222 = Sugar Maple - Yellow Buckeye - American Basswood Forest, 6271 = Oak / Ericad Forest, 6286 = Oak / Great Laurel Forest, 6304 = Eastern Hemlock Plateau Forest and Successional Pitch Pine Forest, 7119 = Cliff Top Virginia Pine Forest, 7221 = Successional Tuliptree Forest, 7267 = Oak - Hickory Forest, 7268 = Oak / Great Laurel Forest, 7543 = Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest, 7861 = Yellow Birch Cold Cove Forest, 8524 = Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest.



Dendrogram 1 (page 2 of 2). Hierarchical agglomerative cluster analysis of upland forests. Symbology indicates codes of associations in the U. S. National Vegetation Classification: 0 = unclassified plot, 2591 = Successional Virginia Pine Forest, 5222 = Sugar Maple - Yellow Buckeye - American Basswood Forest, 6271 = Oak / Ericad Forest, 6286 = Oak / Great Laurel Forest, 6304 = Eastern Hemlock Plateau Forest and Successional Pitch Pine Forest, 7119 = Cliff Top Virginia Pine Forest, 7221 = Successional Tuliptree Forest, 7267 = Oak - Hickory Forest, 7268 = Oak / Great Laurel Forest, 7543 = Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest, 7861 = Yellow Birch Cold Cove Forest, 8524 = Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest.



Graph 1. Nonmetric Multidimensional Scaling ordination of upland forest plots in species space. Symbology indicates codes of associations in the U. S. National Vegetation Classification: 0 = unclassified plot, 2591 = Successional Virginia Pine Forest, 5222 = Sugar Maple - Yellow Buckeye - American Basswood Forest, 6271 = Oak / Ericad Forest, 6286 = Oak / Great Laurel Forest, 6304 = Eastern Hemlock Plateau Forest and Successional Pitch Pine Forest, 7119 = Cliff Top Virginia Pine Forest, 7221 = Successional Tuliptree Forest, 7267 = Oak - Hickory Forest, 7268 = Oak / Great Laurel Forest, 7543 = Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest, 7861 = Yellow Birch Cold Cove Forest, 8524 = Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest.


Information Remaining (%)
100
75
50
25
0
Plots
3725
4286
4418
4510
6462
6620
6624
6623
7221
7853
GARI.1
GARI.128
GARI.32
GARI.67
GARI.10
GARI.13
GARI.21
GARI.2
GARI.29
GARI.30
GARI.17
GARI.23
GARI.24
GARI.22
GARI.25
GARI.100
GARI.47
GARI.91
GARI.109
GARI.97
GARI.108
GARI.127
GARI.40
GARI.217
GARI.70
GARI.92
GARI.81
GARI.101
GARI.12
GARI.4
GARI.28
GARI.5
GARI.8
GARI.15
GARI.20
GARI.27
GARI.16
GARI.83
GARI.87
GARI.19
GARI.11
GARI.14
GARI.6
GARI.3
GARI.9
GARI.112
GARI.148
GARI.156
GARI.117
GARI.118
GARI.26
GARI.82
GARI.155
GARI.173
GARI.211
GARI.84
GARI.125
GARI.207
GARI.90
GARI.215
GARI.119
GARI.149
GARI.68
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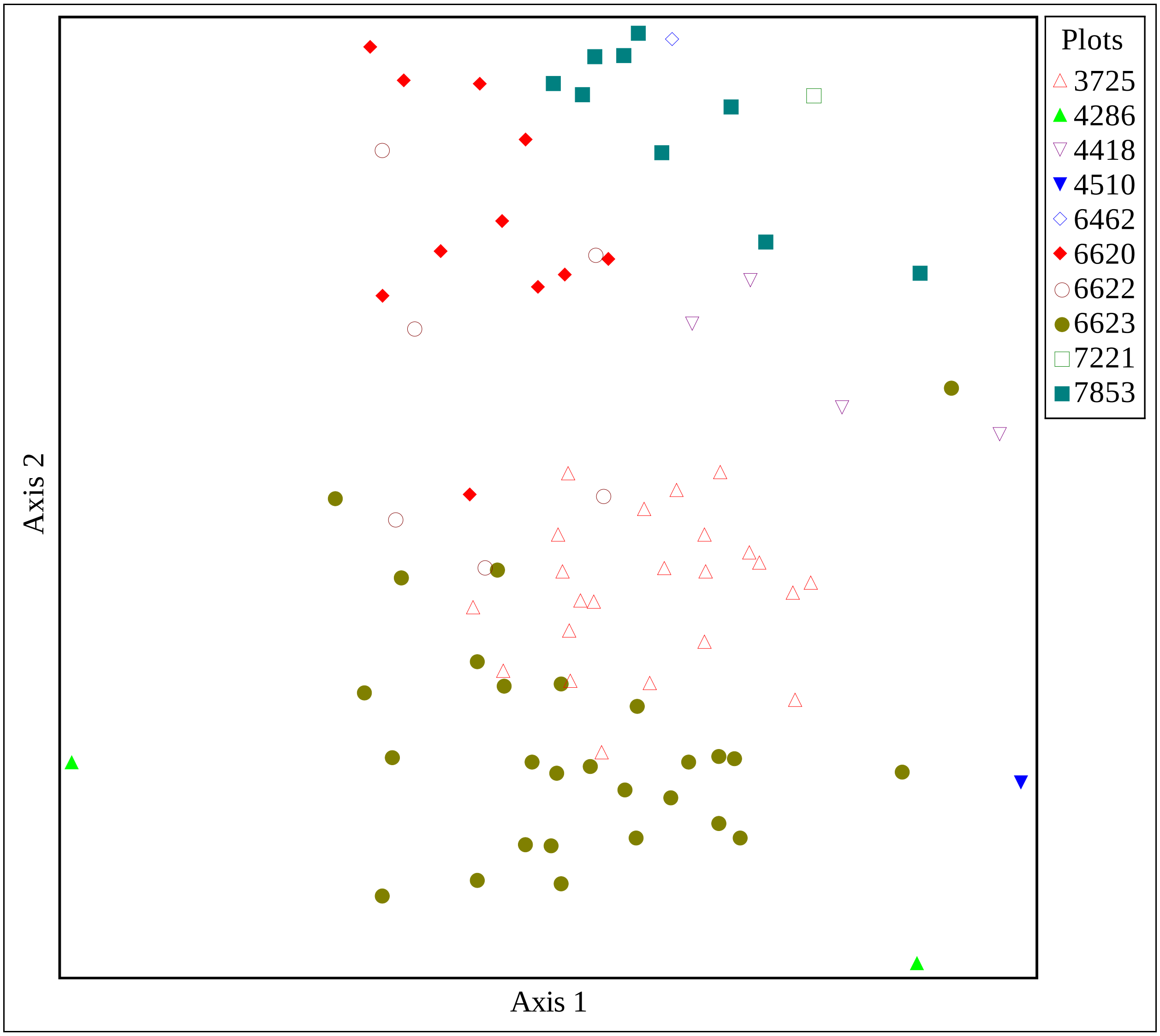
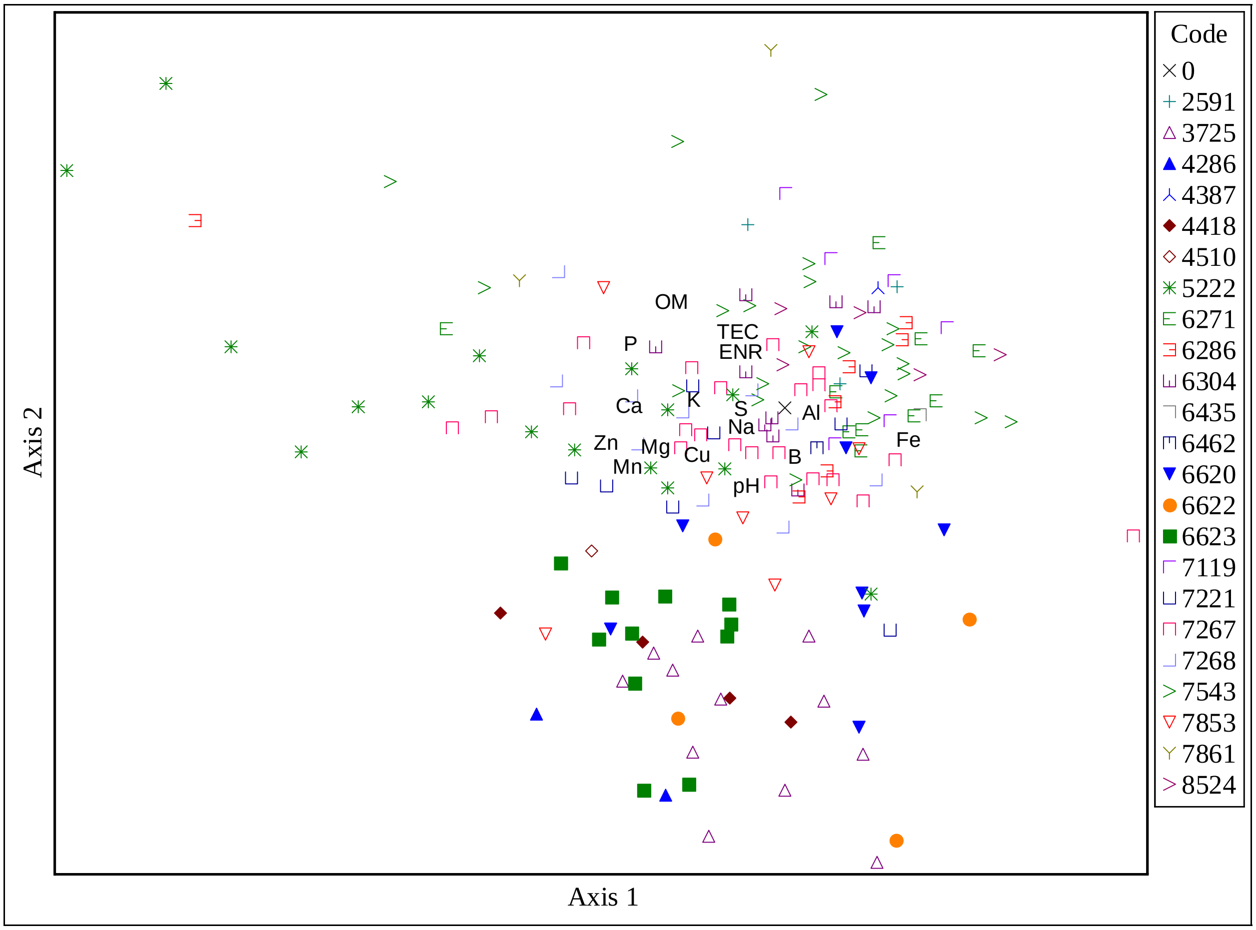
GARI.154
GARI.41
GARI.48
GARI.7
GARI.122
GARI.124
GARI.214
GARI.213
GARI.88
GARI.169
GARI.189
GARI.33
GARI.136
GARI.96
GARI.192
GARI.200
GARI.46
GARI.195
GARI.89

Dendrogram 2 (previous page). Hierarchical agglomerative cluster analysis of riparian and wetland communities. Symbology indicates codes of associations in the U. S. National Vegetation Classification: 3725 = American Sycamore - River Birch Riverscour Woodland, 4286 = American Water-willow Cobble Bar, 4418 = American Sycamore - Tuliptree - Sweetgum Floodplain Forest, 4510 = Bur-reed Marsh, 6462 = Oak - Hickory Floodplain Forest, 6620 = Eastern Hemlock Floodplain Forest, 6624 = (Virginia, Pitch) Pine Floodplain Forest, 6623 = Riverscour Shrub Prairie, 7721 = Successional Tuliptree Forest, 7853 = Forest Seep.



Graph 2. Nonmetric Multidimensional Scaling ordination of riparian and wetland plots in species space. Symbology indicates codes of associations in the U. S. National Vegetation Classification: 3725 = American Sycamore - River Birch Riverscour Woodland, 4286 = American Water-willow Cobble Bar, 4418 = American Sycamore - Tuliptree - Sweetgum Floodplain Forest, 4510 = Bur-reed Marsh, 6462 = Oak - Hickory Floodplain Forest, 6620 = Eastern Hemlock Floodplain Forest, 6624 = (Virginia, Pitch) Pine Floodplain Forest, 6623 = Riverscour Shrub Prairie, 7721 = Successional Tuliptree Forest, 7853 = Forest Seep.



Graph 3. Nonmetric Multidimensional Scaling ordination of plots in soil chemistry space. The graph was rotated to maximize Fe to the right along axis one. Positions of chemical symbols (Al, B, Ca, Cu, ENR [estimated N release], K, Mn, Mg, Na, P, pH, S, TEC [total exchange capacity], and Zn) were manually moved slightly away from the center to reduce clutter but their relative positions as plotted by the ordination were maintained. Symbology for plots indicates codes of associations in the U. S. National Vegetation Classification. Closed polygon symbols represent riparian and wetland associations. Open line symbols represent upland associations. 0 = unclassified plot, 2591 = Successional Virginia Pine Forest, 3725 = American Sycamore - River Birch Riverscour Woodland, 4286 = American Water-willow Cobble Bar, 4387 = Common Rocktrip Cliff Face, 4418 = American Sycamore - Tuliptree - Sweetgum Floodplain Forest, 4510 = Bur-reed Marsh, 5222 = Sugar Maple - Yellow Buckeye - American Basswood Forest, 6271 = Oak / Ericad Forest, 6286 = Oak / Great Laurel Forest, 6304 = Eastern Hemlock Plateau Forest and Successional Pitch Pine Forest, 6435 = Dry Cliff Face, 6462 = Oak - Hickory Floodplain Forest, 6620 = Eastern Hemlock Floodplain Forest, 6624 = (Virginia, Pitch) Pine Floodplain Forest, 6623 = Riverscour Shrub Prairie, 7119 = Cliff Top Virginia Pine Forest, 7267 = Oak - Hickory Forest, 7268 = Oak / Great Laurel Forest, 7543 = Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest, 7721 = Successional Tuliptree Forest, 7853 = Forest Seep, 7861 = Yellow Birch Cold Cove Forest, 8524 = Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest.

Appendix G. Soil chemical analysis: mean and standard deviation by community type.

	American Sycamore – River Birch Riverscour Woodland	**American Sycamore - Tuliptree - Sweetgum Floodplain Forest**	**American Water-willow Cobble Bar**	**Bur-reed Marsh**	**Cliff Top Virginia Pine Forest**	**Common Rock Tripe Cliff Face**	**Dry Cliff Face**	**Eastern Hemlock – Chestnut Oak / Catawba Rosebay Forest**	**Eastern Hemlock Floodplain Forest**	**Eastern Hemlock – Oak – Sweet Birch / Great Laurel Forest**	**Eastern Hemlock Plateau Forest**	**Forest Seep**	**Grand Values**
# of Samples	12	4	2	1	6	1	1	5	9	22	8	8	178
Mean of TEC	2.96	4.54	3.24	10.25	26.20	26.30	11.55	24.88	12.02	23.21	20.58	9.84	15.66
StdDev of TEC	1.36	1.68	1.46		9.68			6.69	8.62	6.54	6.21	3.96	8.82
Mean of pH	5.29	5.85	5.80	4.90	3.95	4.00	4.40	4.08	4.57	4.17	4.35	4.39	4.63
StdDev of pH	0.56	0.30	0.28		0.29			0.26	0.57	0.29	0.43	0.35	0.65
Mean of OrganicMatter	1.19	2.21	1.47	5.20	11.67	16.91	8.98	10.23	5.28	17.76	8.63	4.34	9.72
StdDev of OrganicMatter	0.65	1.46	0.76		5.09			5.47	2.99	16.34	3.32	1.06	12.24
Mean of ENR	40.42	60.00	48.50	101.00	121.50	128.00	120.00	116.00	90.78	120.50	113.88	92.50	100.78
StdDev of ENR	17.23	27.47	16.26		8.50			14.78	32.78	10.30	12.18	10.18	29.28
Mean of SolubleSulfur	16.00	8.50	15.50	64.00	25.17	25.00	26.00	27.00	19.22	25.86	31.25	27.00	23.13
StdDev of SolubleSulfur	3.07	1.73	2.12		6.40			4.00	7.34	11.23	11.52	16.43	9.95
Mean of Al_ppm	276.08	424.25	266.50	477.00	1109.50	1282.00	1130.00	1003.80	522.33	845.77	1161.75	841.38	782.39
StdDev of Al_ppm	84.81	197.58	79.90		244.03			304.22	222.84	269.25	235.28	213.54	361.54
Mean of B_ppm	0.35	0.39	0.37	0.70	0.44	0.82	0.61	0.39	0.56	0.51	0.24	0.27	0.48
StdDev of B_ppm	0.11	0.12	0.00		0.19			0.13	0.26	0.47	0.06	0.13	0.36
Mean of Ca_ppm	392.50	635.00	464.50	512.00	372.67	172.00	166.00	285.00	317.22	389.73	502.50	395.25	568.01
StdDev of Ca_ppm	173.04	255.22	225.57		315.60			275.48	162.42	226.09	269.88	194.58	573.56
Mean of Cu_ppm	0.90	1.64	1.30	1.01	0.64	0.82	0.89	0.48	1.51	0.73	0.69	1.41	1.06
StdDev of Cu_ppm	0.66	0.92	0.94		0.30			0.18	1.38	0.39	0.27	0.55	0.77
Mean of Fe_ppm	199.50	209.75	300.00	546.00	285.83	519.00	340.00	307.20	282.44	246.41	168.63	221.63	208.49
StdDev of Fe_ppm	44.28	73.46	132.94		105.67			93.73	95.96	98.26	39.17	65.29	92.93
Mean of K_ppm	27.50	50.25	26.00	52.00	58.17	89.00	59.00	65.60	47.56	76.73	75.38	62.38	73.46
StdDev of K_ppm	9.30	13.50	15.56		23.50			23.33	16.61	43.07	24.11	10.16	42.28
Mean of Mg_ppm	78.58	138.50	93.50	113.00	37.33	38.00	36.00	41.60	65.22	51.36	51.25	90.25	82.56
StdDev of Mg_ppm	29.89	44.74	31.82		7.87			13.11	31.28	23.20	20.85	35.44	66.11
Mean of Mn_ppm	185.92	133.50	403.00	45.00	5.33	18.00	8.00	16.80	58.22	68.18	107.38	96.25	115.37
StdDev of Mn_ppm	63.71	66.14	84.85		5.13			19.12	49.20	108.70	70.68	60.68	126.36
Average of Na_ppm	13.42	18.50	16.00	16.00	16.00	17.00	16.00	16.20	17.44	18.05	20.13	23.75	17.53
StdDev of Na_ppm	3.09	4.93	5.66		3.16			6.50	4.85	6.90	9.43	9.16	6.01
Mean of P_ppm	6.50	4.00	5.00	12.00	13.67	7.00	2.00	10.00	9.22	16.73	16.38	17.63	15.22
StdDev of P_ppm	1.62	0.82	1.41		11.31			3.16	5.54	14.57	7.80	21.08	17.77
Mean of Zn_ppm	5.43	6.67	8.90	12.08	1.32	1.67	0.74	2.07	4.78	3.19	2.37	3.18	4.40
StdDev of Zn_ppm	2.47	4.79	1.94		0.55			1.11	3.20	3.15	0.97	1.91	5.31

	Oak / Ericad Forest	Oak / Great Laurel Forest	Oak – Hickory Floodplain Forest	Oak – Hickory Forest	Oak – Hickory – Sugar Maple Forest	Riverscour Shrub Prairie	Successional Pitch Pine Forest	Successional Tuliptree Forest	Successional Virginia Pine Forest	Sugar Maple – Yellow Buckeye - American Basswood Forest	(Virginia, Pitch) Pine Floodplain Forest	Yellow Birch Cold Cove Forest	Grand Values
# of Samples	10	7	1	23	10	11	1	8	3	17	4	3	178
Mean of TEC	17.15	20.85	12.22	15.11	14.63	4.75	10.15	15.51	21.92	19.92	7.05	24.06	15.66
StdDev of TEC	4.00	6.52		4.89	4.43	1.89		7.17	6.86	7.17	5.28	13.30	8.82
Mean of pH	4.44	4.20	4.10	4.59	4.70	5.75	4.80	4.40	4.40	4.76	5.28	4.33	4.63
StdDev of pH	0.20	0.30		0.44	0.51	0.52		0.43	0.26	0.68	0.70	0.55	0.65
Mean of OrganicMatter	9.70	12.02	3.47	8.69	8.27	2.62	6.63	6.77	4.25	17.92	2.30	39.28	9.72
StdDev of OrganicMatter	9.29	11.39		4.38	4.10	1.55		3.25	1.02	22.02	2.26	35.14	12.24
Mean of ENR	110.00	115.43	85.00	112.61	111.90	66.18	108.00	103.75	91.67	117.18	56.25	122.33	100.78
StdDev of ENR	14.29	11.49		12.04	11.49	26.14		22.10	9.50	15.55	35.02	15.01	29.28
Mean of SolubleSulfur	26.10	23.57	27.00	23.17	20.00	18.73	27.00	20.13	45.33	24.35	14.00	13.00	23.13
StdDev of SolubleSulfur	10.65	4.58		4.91	4.67	4.43		4.64	13.05	10.02	4.76	3.00	9.95
Mean of Al_ppm	930.80	839.14	585.00	1007.04	902.10	357.91	1194.00	836.25	1393.33	719.29	325.50	470.33	782.39
StdDev of Al_ppm	291.67	105.76		267.52	113.82	87.27		384.84	226.02	383.97	111.98	168.42	361.54
Mean of B_ppm	0.44	0.37	0.23	0.59	0.45	0.48	0.77	0.60	0.43	0.63	0.47	0.38	0.48
StdDev of B_ppm	0.28	0.19		0.70	0.21	0.17		0.15	0.27	0.32	0.24	0.22	0.36
Mean of Ca_ppm	362.80	413.57	511.00	482.87	644.30	614.18	373.00	620.25	697.67	1613.29	343.25	570.67	568.01
StdDev of Ca_ppm	467.07	519.14		385.26	548.00	241.39		366.24	392.92	1108.89	237.57	686.52	573.56
Mean of Cu_ppm	0.67	1.46	0.66	0.98	1.13	1.52	0.95	1.15	0.60	1.50	0.98	0.82	1.06
StdDev of Cu_ppm	0.35	2.24		0.37	0.46	0.71		0.47	0.38	0.83	0.41	0.12	0.77
Mean of Fe_ppm	223.20	226.57	227.00	151.74	181.90	217.27	120.00	172.13	228.33	107.53	207.25	252.67	208.49
StdDev of Fe_ppm	103.57	100.18		52.71	36.17	31.95		50.18	135.32	45.06	58.09	94.33	92.93
Mean of K_ppm	69.50	80.71	66.00	92.96	108.50	44.91	63.00	81.13	66.33	117.35	29.75	85.00	73.46
StdDev of K_ppm	32.94	59.96		37.68	29.06	21.88		39.02	23.12	61.22	15.95	33.78	42.28
Mean of Mg_ppm	45.60	58.00	54.00	70.35	86.20	126.55	34.00	104.38	35.33	179.88	80.00	114.33	82.56
StdDev of Mg_ppm	29.11	38.90		54.58	37.18	51.86		67.83	7.64	122.73	44.03	126.23	66.11
Mean of Mn_ppm	47.50	168.86	54.00	138.91	123.50	188.36	147.00	91.50	29.00	198.76	110.00	25.00	115.37
StdDev of Mn_ppm	93.61	313.27		113.44	72.21	85.66		60.27	31.10	184.77	66.35	26.06	126.36
Average of Na_ppm	15.00	14.86	15.00	19.35	20.40	18.64	18.00	14.13	12.67	15.47	22.75	21.00	17.53
StdDev of Na_ppm	3.43	3.48		5.67	6.38	4.34		3.09	1.15	4.69	11.03	3.61	6.01
Mean of P_ppm	11.50	21.43	17.00	15.52	27.50	6.82	5.00	13.75	16.67	30.29	3.50	11.33	15.22
StdDev of P_ppm	6.98	30.82		6.71	23.67	1.89		5.06	1.53	39.29	1.73	5.51	17.77
Mean of Zn_ppm	2.40	3.83	1.21	4.01	3.72	6.85	2.64	3.58	1.35	9.75	3.96	2.25	4.40
StdDev of Zn_ppm	2.88	4.93		3.84	1.86	2.51		1.63	0.40	13.35	2.94	1.39	5.31

Appendix H. Plot floristic cover statistics for community types sampled in Gauley River National Recreation Area.

Tables are arranged alphabetically by the GARI community name for the association. The code for the association in the U. S. National Vegetation Classification is listed in parentheses. Plant taxa in the tables are sorted in descending order of the number of plots that a taxon occurs in ("N"), then in descending order of mean cover, then in ascending alphabetical order. N divided by the total number of plots for the association is a measure of constancy. The mean statistic is calculated based on the number of plots where the taxon is present (N).

American Sycamore - River Birch Riverscour Woodland (CEGL003725) - 23 plots.

Species	% Cover Mean	Min	Max	N
Betula nigra	21.0	0.5	45	23
Cornus amomum	3.9	0.01	15	22
Physocarpus opulifolius var. *opulifolius*	4.0	0.5	20	21
Dichanthelium clandestinum	2.2	0.01	10	21
Rudbeckia laciniata var. *laciniata*	0.9	0.01	5	21
Toxicodendron radicans	2.4	0.01	10	20
Trautvetteria caroliniensis var. *caroliniensis*	0.9	0.01	3	20
Ilex verticillata	7.9	0.01	25	19
Eupatorium fistulosum	0.9	0.01	3	19
Xanthorhiza simplicissima	3.0	0.01	20	18
Osmunda regalis var. *spectabilis*	6.9	0.5	35	17
Andropogon gerardii	2.7	0.5	10	17
Solidago simplex ssp. *randii* var. *racemosa*	1.0	0.01	4	16
Tsuga canadensis	2.3	0.01	15	15
Deschampsia flexuosa var. *flexuosa*	1.2	0.01	5	15
Rosa carolina var. *carolina*	0.8	0.01	3	15
Rubus	1.4	0.5	3	14
Platanus occidentalis	11.8	0.01	50	13
Alnus serrulata	4.5	0.5	25	13
Acer rubrum	3.7	0.5	20	13
Solidago rugosa	1.5	0.5	5	13
Smilax glauca	1.4	0.01	5	13
Viburnum nudum var. *cassinoides*	1.4	0.01	8	13
Packera paupercula	0.8	0.01	1	13
Clematis virginiana	0.5	0.01	1	13
Nyssa sylvatica	4.4	0.01	25	12
Eurybia divaricata	1.9	0.01	8	12
Hypericum prolificum	1.8	0.5	6	12
Rhododendron arborescens	1.3	0.5	3	12
Potentilla canadensis var. *canadensis*	1.0	0.01	4	12
Euphorbia corollata	0.8	0.01	2	12
Polystichum acrostichoides	0.4	0.01	1	12
Packera aurea	1.8	0.5	5	11
Zizia aptera	1.2	0.01	5	11
Diospyros virginiana	5.3	0.5	25	10
Dichanthelium dichotomum	4.7	0.5	20	10
Viola	1.1	0.5	2	10
Houstonia caerulea	0.6	0.5	1	10
Prunella vulgaris	0.6	0.01	1	10
Carpinus caroliniana ssp. *virginiana*	5.1	0.5	30	9
Liriodendron tulipifera	2.5	0.01	15	9
Kalmia latifolia	2.1	0.5	8	9
Carex torta	1.6	0.01	7	9
Pedicularis canadensis ssp. *canadensis*	0.9	0.01	5	9
Symphyotrichum lateriflorum	0.9	0.5	2	9
Ipomoea pandurata	0.7	0.01	2	9
Symphyotrichum prenanthoides	0.6	0.5	1	9
Thalictrum	0.5	0.01	1	9
Smilax herbacea	0.3	0.01	1	9
Hypoxis hirsuta	0.2	0.01	0.5	9
Rosa multiflora	2.8	0.5	10	8
Vaccinium corymbosum	2.8	0.5	7	8
Verbesina alternifolia	2.1	0.5	10	8
Hamamelis virginiana	1.9	0.01	8	8
Lysimachia ciliata	0.9	0.01	5	8
Symphyotrichum laeve var. *concinnum*	0.9	0.01	3	8
Coreopsis tripteris	0.8	0.01	2	8
Dichanthelium dichotomum ssp. *dichotomum*	0.5	0.01	1	8
Elymus riparius	0.5	0.01	1	8
Rhododendron periclymenoides	2.4	0.5	6	7
Chionanthus virginicus	2.3	1	7	7
Viola cucullata	0.6	0.01	2	7
Muhlenbergia tenuiflora	0.5	0.5	0.5	7
Spiraea virginiana	9.0	1	20	6
Fraxinus americana	5.8	0.5	15	6
Symphyotrichum lanceolatum	0.8	0.5	1	6
Potentilla simplex	0.7	0.01	1	6
Ilex opaca var. *opaca*	0.7	0.5	1	6
Dichanthelium polyanthes	0.5	0.01	1	6
Liatris scariosa var. *scariosa*	0.5	0.01	1	6
Houstonia serpyllifolia	0.3	0.01	1	6
Lespedeza cuneata	0.2	0.01	0.5	6

Liquidambar styraciflua	5.4	0.5	15	5
Solidago gigantea	2.7	0.5	8	5
Smilax rotundifolia	1.2	0.5	3	5
Cephalanthus occidentalis	1.0	0.01	2	5
Ionactis linariifolius	0.9	0.01	3	5
Polygonum cuspidatum	0.9	0.01	3	5
Sorghastrum nutans	0.9	0.5	2	5
Aristolochia macrophylla	0.8	0.5	1	5
Linum virginianum	0.6	0.5	1	5
Doellingeria umbellata var. *umbellata*	0.5	0.01	1	5
Rubus flagellaris	0.3	0.01	1	5
Lysimachia lanceolata	0.3	0.01	0.5	5
Schistidium apocarpum	1.1	0.5	2	4
Robinia pseudoacacia	1.0	0.01	2	4
Phlox maculata	1.0	0.5	2	4
Vaccinium pallidum	0.6	0.5	1	4
Carex	0.5	0.01	1	4
Erigeron pulchellus	0.5	0.01	1	4
Fraxinus pennsylvanica	0.5	0.01	1	4
Helenium autumnale var. *autumnale*	0.5	0.01	1	4
Lobelia cardinalis	0.5	0.01	1	4
Agrostis perennans	0.4	0.01	1	4
Physostegia virginiana ssp. *virginiana*	0.4	0.01	1	4
Schizachyrium scoparium var. *scoparium*	0.4	0.01	1	4
Lycopus uniflorus var. *uniflorus*	0.4	0.01	0.5	4
Oxalis	0.4	0.01	0.5	4
Viola pedata	0.4	0.01	0.5	4
Boehmeria cylindrica	0.3	0.01	0.5	4
Salix caroliniana	0.3	0.01	0.5	4
Leucanthemum vulgare	0.1	0.01	0.5	4
Helianthus decapetalus	5.2	0.5	10	3
Parthenocissus quinquefolia	3.7	1	5	3
Thelypteris noveboracensis	3.7	0.5	10	3
Phlox paniculata	2.7	1	4	3
Grimmia laevigata	2.3	0.01	5	3
Juniperus virginiana var. *virginiana*	1.8	0.5	4	3
Panicum virgatum	1.3	0.01	3	3
Cornus florida	1.2	0.01	3	3
Bryoandersonia illecebra	1.2	0.5	2	3
Coreopsis major	0.8	0.01	2	3
Climacium americanum	0.8	0.5	1	3
Lolium pratense	0.7	0.5	1	3
Salix sericea	0.7	0.5	1	3
Oxypolis rigidior	0.5	0.01	1	3
Hypericum perforatum	0.5	0.5	0.5	3
Iris	0.5	0.5	0.5	3
Ranunculus hispidus var. *nitidus*	0.5	0.5	0.5	3
Marshallia grandiflora	0.3	0.01	0.5	3
Polygonum caespitosum var. *longisetum*	0.3	0.01	0.5	3
Sedum ternatum	0.3	0.01	0.5	3
Linum striatum	0.2	0.01	0.5	3
Smilax tamnoides	0.2	0.01	0.5	3
Anemone quinquefolia var. *quinquefolia*	0.01	0.01	0.01	3
Eleocharis tenuis	0.01	0.01	0.01	3
Phlox maculata ssp. *pyramidalis*	0.01	0.01	0.01	3
Viola ×primulifolia	0.01	0.01	0.01	3
Acer saccharum var. *saccharum*	22.8	0.5	45	2
Salix nigra	7.8	0.5	15	2
Ulmus americana	6.5	1	12	2
Dichanthelium	3.0	1	5	2
Glechoma hederacea	2.0	1	3	2
Pteridium aquilinum	1.8	0.5	3	2
Lonicera japonica	1.0	1	1	2
Agrostis gigantea	0.8	0.5	1	2
Anthoxanthum odoratum ssp. *odoratum*	0.8	0.5	1	2
Carya alba	0.8	0.5	1	2
Cladonia	0.8	0.5	1	2
Euonymus americana	0.8	0.5	1	2
Lysimachia quadrifolia	0.8	0.5	1	2
Muhlenbergia	0.8	0.5	1	2
Ranunculus hispidus var. *hispidus*	0.8	0.5	1	2
Eurybia schreberi	0.5	0.01	1	2
Gaylussacia baccata	0.5	0.01	1	2
Uvularia	0.5	0.01	1	2
Desmodium pauciflorum	0.5	0.5	0.5	2
Dichanthelium commutatum	0.5	0.5	0.5	2
Elaeagnus umbellata var. *parvifolia*	0.5	0.5	0.5	2
Leersia virginica	0.5	0.5	0.5	2

Lilium superbum	0.5	0.5	0.5	2
Polygonum virginianum	0.5	0.5	0.5	2
Prunus	0.5	0.5	0.5	2
Salix alba	0.5	0.5	0.5	2
Solidago bicolor	0.5	0.5	0.5	2
Thalictrum pubescens	0.5	0.5	0.5	2
Vaccinium stamineum	0.5	0.5	0.5	2
Baptisia tinctoria	0.3	0.01	0.5	2
Chelone glabra	0.3	0.01	0.5	2
Dichanthelium acuminatum ssp. *fasciculatum*	0.3	0.01	0.5	2
Justicia americana	0.3	0.01	0.5	2
Plantago rugelii var. *rugelii*	0.3	0.01	0.5	2
Poa alsodes	0.3	0.01	0.5	2
Rhynchospora capitellata	0.3	0.01	0.5	2
Sphagnum lescurii	0.3	0.01	0.5	2
Vaccinium	0.3	0.01	0.5	2
Bidens	0.0	0.01	0.01	2
Bryum	0.0	0.01	0.01	2
Chrysopsis mariana	0.0	0.01	0.01	2
Iris cristata	0.0	0.01	0.01	2
Lobelia	0.0	0.01	0.01	2
Mitchella repens	0.0	0.01	0.01	2
Chasmanthium latifolium	15.0	15	15	1
Carya glabra	10.0	10	10	1
Betula alleghaniensis var. *alleghaniensis*	5.0	5	5	1
Hedwigia ciliata	5.0	5	5	1
Catalpa bignonioides	3.0	3	3	1
Dermatocarpon luridum	3.0	3	3	1
Leersia	3.0	3	3	1
Prunus serotina var. *serotina*	3.0	3	3	1
Scapania nemorea	3.0	3	3	1
Athyrium filix-femina	2.0	2	2	1
Porella pinnata	2.0	2	2	1
Rhododendron maximum	2.0	2	2	1
Vitis riparia	2.0	2	2	1
Ambrosia trifida var. *trifida*	1.0	1	1	1
Apios americana	1.0	1	1	1
Brachyelytrum erectum	1.0	1	1	1
Bryum pseudotriquetrum	1.0	1	1	1
Coccocarpia palmicola	1.0	1	1	1
Conocephalum conicum	1.0	1	1	1

Coreopsis pubescens var. *pubescens*	1.0	1	1	1
Cuscuta pentagona var. *pentagona*	1.0	1	1	1
Euthamia graminifolia var. *graminifolia*	1.0	1	1	1
Heliopsis helianthoides	1.0	1	1	1
Hemerocallis fulva	1.0	1	1	1
Leucolejeunea clypeata	1.0	1	1	1
Lindera benzoin var. *pubescens*	1.0	1	1	1
Lysimachia nummularia	1.0	1	1	1
Magnolia acuminata	1.0	1	1	1
Menispermum canadense	1.0	1	1	1
Pellia epiphylla	1.0	1	1	1
Sematophyllum demissum	1.0	1	1	1
Solidago juncea var. *juncea*	1.0	1	1	1
Symphyotrichum praealtum	1.0	1	1	1
Viburnum recognitum	1.0	1	1	1
Achillea millefolium var. *occidentalis*	0.5	0.5	0.5	1
Ageratina altissima var. *altissima*	0.5	0.5	0.5	1
Agrostis	0.5	0.5	0.5	1
Amelanchier stolonifera	0.5	0.5	0.5	1
Aster	0.5	0.5	0.5	1
Athyrium filix-femina ssp. *asplenioides*	0.5	0.5	0.5	1
Atrichum undulatum	0.5	0.5	0.5	1
Aulacomnium palustre	0.5	0.5	0.5	1
Bidens coronata	0.5	0.5	0.5	1
Carex gracillima	0.5	0.5	0.5	1
Catalpa	0.5	0.5	0.5	1
Collinsonia canadensis	0.5	0.5	0.5	1
Coreopsis	0.5	0.5	0.5	1
Dichanthelium dichotomum ssp. *yadkinense*	0.5	0.5	0.5	1
Dicranum	0.5	0.5	0.5	1
Equisetum arvense	0.5	0.5	0.5	1
Eupatorium	0.5	0.5	0.5	1
Fagus grandifolia	0.5	0.5	0.5	1
Fissidens	0.5	0.5	0.5	1
Galium	0.5	0.5	0.5	1
Grimmia	0.5	0.5	0.5	1
Helianthus	0.5	0.5	0.5	1
Helianthus giganteus	0.5	0.5	0.5	1

Hypericum ellipticum	0.5	0.5	0.5	1
Hypericum hypericoides ssp. *multicaule*	0.5	0.5	0.5	1
Hypericum punctatum	0.5	0.5	0.5	1
Hypnum imponens	0.5	0.5	0.5	1
Juncus	0.5	0.5	0.5	1
Lespedeza repens	0.5	0.5	0.5	1
Lilium canadense	0.5	0.5	0.5	1
Lindera benzoin	0.5	0.5	0.5	1
Maianthemum racemosum ssp. *racemosum*	0.5	0.5	0.5	1
Microstegium vimineum	0.5	0.5	0.5	1
Muhlenbergia schreberi	0.5	0.5	0.5	1
Muhlenbergia sylvatica	0.5	0.5	0.5	1
Oenothera	0.5	0.5	0.5	1
Onoclea sensibilis	0.5	0.5	0.5	1
Osmunda claytoniana	0.5	0.5	0.5	1
Parmelia	0.5	0.5	0.5	1
Penthorum sedoides	0.5	0.5	0.5	1
Quercus	0.5	0.5	0.5	1
Quercus alba	0.5	0.5	0.5	1
Quercus palustris	0.5	0.5	0.5	1
Salix fragilis	0.5	0.5	0.5	1
Sambucus nigra ssp. *canadensis*	0.5	0.5	0.5	1
Sisyrinchium angustifolium	0.5	0.5	0.5	1
Solidago flexicaulis	0.5	0.5	0.5	1
Streptopus lanceolatus var. *roseus*	0.5	0.5	0.5	1
Symphyotrichum	0.5	0.5	0.5	1
Symphyotrichum dumosum var. *dumosum*	0.5	0.5	0.5	1
Symphyotrichum puniceum var. *puniceum*	0.5	0.5	0.5	1
Symphyotrichum racemosum	0.5	0.5	0.5	1
Tephrosia virginiana	0.5	0.5	0.5	1
Thalictrum clavatum	0.5	0.5	0.5	1
Thuidium	0.5	0.5	0.5	1
Tilia americana	0.5	0.5	0.5	1
Trifolium	0.5	0.5	0.5	1
Viburnum	0.5	0.5	0.5	1
Viola sororia	0.5	0.5	0.5	1
Vitis	0.5	0.5	0.5	1
Abrothallus cladoniae	0.01	0.01	0.01	1
Amelanchier	0.01	0.01	0.01	1
Anomodon attenuatus	0.01	0.01	0.01	1
Bidens frondosa	0.01	0.01	0.01	1
Campsis radicans	0.01	0.01	0.01	1
Campylium	0.01	0.01	0.01	1
Cicuta maculata var. *maculata*	0.01	0.01	0.01	1
Daucus carota	0.01	0.01	0.01	1
Dichanthelium dichotomum ssp. *microcarpon*	0.01	0.01	0.01	1
Dryopteris intermedia	0.01	0.01	0.01	1
Elephantopus carolinianus	0.01	0.01	0.01	1
Elymus canadensis	0.01	0.01	0.01	1
Eupatorium purpureum var. *purpureum*	0.01	0.01	0.01	1
Eurybia	0.01	0.01	0.01	1
Glyceria striata	0.01	0.01	0.01	1
Impatiens	0.01	0.01	0.01	1
Leucobryum albidum	0.01	0.01	0.01	1
Lonicera morrowii	0.01	0.01	0.01	1
Muhlenbergia frondosa	0.01	0.01	0.01	1
Poa cuspidata	0.01	0.01	0.01	1
Polygala polygama	0.01	0.01	0.01	1
Polygonatum biflorum	0.01	0.01	0.01	1
Pyrularia pubera	0.01	0.01	0.01	1
Quercus rubra	0.01	0.01	0.01	1
Rhus copallinum	0.01	0.01	0.01	1
Scirpus cyperinus	0.01	0.01	0.01	1
Solidago	0.01	0.01	0.01	1
Symphyotrichum cordifolium	0.01	0.01	0.01	1
Thuidium delicatulum	0.01	0.01	0.01	1
Ulmus rubra	0.01	0.01	0.01	1
Verbesina occidentalis	0.01	0.01	0.01	1
Vitis aestivalis	0.01	0.01	0.01	1
Xanthium strumarium var. *glabratum*	0.01	0.01	0.01	1

American Sycamore - Tuliptree - Sweetgum Floodplain Forest (CEGL004418) - 4 plots.

Species	% Cover Mean	Min	Max	N
Carpinus caroliniana ssp. *virginiana*	28.5	2	45	4
Liquidambar styraciflua	13.8	5	24	4
Betula nigra	11.0	2	25	4
Rudbeckia laciniata var. *laciniata*	3.0	0.5	10	4
Parthenocissus quinquefolia	1.5	0.5	3	4
Rosa multiflora	1.0	0.5	2	4
Packera aurea	0.8	0.5	1	4
Dichanthelium clandestinum	0.5	0.01	1	4
Platanus occidentalis	19.3	15	23	3
Liriodendron tulipifera	13.3	10	15	3
Xanthorhiza simplicissima	6.8	0.01	20	3
Toxicodendron radicans	2.0	0.5	5	3
Microstegium vimineum	1.3	0.01	3	3
Helianthus	1.0	0.01	2	3
Fraxinus pennsylvanica	0.8	0.01	2	3
Glechoma hederacea	0.8	0.5	1	3
Aesculus flava	0.7	0.01	1	3
Collinsonia canadensis	0.5	0.01	1	3
Eurybia divaricata	0.5	0.01	1	3
Thuidium delicatulum	0.3	0.01	0.5	3
Quercus rubra	0.2	0.01	0.5	3
Symphyotrichum prenanthoides	0.0	0.01	0.01	3
Acer rubrum	12.5	10	15	2
Carya cordiformis	5.0	0.01	10	2
Viola striata	4.3	0.5	8	2
Lindera benzoin	1.3	0.5	2	2
Lindera benzoin var. *pubescens*	1.0	0.01	2	2
Polygonatum pubescens	0.8	0.5	1	2
Polystichum acrostichoides	0.8	0.5	1	2
Ilex opaca var. *opaca*	0.5	0.01	1	2
Carex	0.5	0.5	0.5	2
Lonicera japonica	0.5	0.5	0.5	2
Viola cucullata	0.5	0.5	0.5	2
Poa alsodes	0.3	0.01	0.5	2
Polygonum virginianum	0.3	0.01	0.5	2
Smilax rotundifolia	0.3	0.01	0.5	2
Viola	0.3	0.01	0.5	2
Arisaema triphyllum ssp. *triphyllum*	0.0	0.01	0.01	2
Deparia acrostichoides	0.01	0.01	0.01	2
Duchesnea indica	0.01	0.01	0.01	2
Oxalis dillenii	0.01	0.01	0.01	2
Quercus alba	0.01	0.01	0.01	2
Ulmus rubra	6.0	6	6	1
Maianthemum racemosum ssp. *racemosum*	4.0	4	4	1
Polygonum cuspidatum	3.0	3	3	1
Ulmus americana	3.0	3	3	1
Bryoandersonia illecebra	2.0	2	2	1
Podophyllum peltatum	2.0	2	2	1
Tsuga canadensis	2.0	2	2	1
Atrichum undulatum	1.0	1	1	1
Cornus amomum	1.0	1	1	1
Eupatorium fistulosum	1.0	1	1	1
Eurybia schreberi	1.0	1	1	1
Impatiens	1.0	1	1	1
Phlox paniculata	1.0	1	1	1
Polygonum caespitosum var. *longisetum*	1.0	1	1	1
Verbesina alternifolia	1.0	1	1	1
Vitis	1.0	1	1	1
Ambrosia artemisiifolia var. *elatior*	0.5	0.5	0.5	1
Asimina triloba	0.5	0.5	0.5	1
Brachyelytrum erectum	0.5	0.5	0.5	1
Carex amphibola	0.5	0.5	0.5	1
Carex blanda	0.5	0.5	0.5	1
Dichanthelium boscii	0.5	0.5	0.5	1
Hypnum imponens	0.5	0.5	0.5	1
Iris cristata	0.5	0.5	0.5	1
Lilium superbum	0.5	0.5	0.5	1
Oxalis violacea	0.5	0.5	0.5	1
Phegopteris hexagonoptera	0.5	0.5	0.5	1
Porella pinnata	0.5	0.5	0.5	1
Prunella vulgaris	0.5	0.5	0.5	1
Pylaisiadelpha tenuirostris	0.5	0.5	0.5	1
Rubus	0.5	0.5	0.5	1
Sassafras albidum	0.5	0.5	0.5	1
Smilax ecirrata	0.5	0.5	0.5	1
Solidago gigantea	0.5	0.5	0.5	1

Thalictrum	0.5	0.5	0.5	1
Thelypteris noveboracensis	0.5	0.5	0.5	1
Vaccinium corymbosum	0.5	0.5	0.5	1
Verbesina occidentalis	0.5	0.5	0.5	1
Acer saccharum var. *saccharum*	0.01	0.01	0.01	1
Agrostis perennans	0.01	0.01	0.01	1
Amelanchier arborea var. *arborea*	0.01	0.01	0.01	1
Amphicarpaea bracteata	0.01	0.01	0.01	1
Arnoglossum atriplicifolium	0.01	0.01	0.01	1
Athyrium filix-femina var. *angustum*	0.01	0.01	0.01	1
Cardamine concatenata	0.01	0.01	0.01	1
Cardamine diphylla	0.01	0.01	0.01	1
Chasmanthium latifolium	0.01	0.01	0.01	1
Chelone glabra	0.01	0.01	0.01	1
Dichanthelium dichotomum ssp. *dichotomum*	0.01	0.01	0.01	1
Dryopteris intermedia	0.01	0.01	0.01	1
Elaeagnus umbellata var. *parvifolia*	0.01	0.01	0.01	1
Elephantopus carolinianus	0.01	0.01	0.01	1
Galium triflorum	0.01	0.01	0.01	1
Hamamelis virginiana	0.01	0.01	0.01	1
Houstonia serpyllifolia	0.01	0.01	0.01	1
Kalmia latifolia	0.01	0.01	0.01	1
Laportea canadensis	0.01	0.01	0.01	1
Magnolia tripetala	0.01	0.01	0.01	1
Muhlenbergia schreberi	0.01	0.01	0.01	1
Nyssa sylvatica	0.01	0.01	0.01	1
Osmunda regalis var. *spectabilis*	0.01	0.01	0.01	1
Pedicularis canadensis ssp. *canadensis*	0.01	0.01	0.01	1
Phaeocalicium polyporaeum	0.01	0.01	0.01	1
Phlox	0.01	0.01	0.01	1
Pinus rigida	0.01	0.01	0.01	1
Plantago rugelii var. *rugelii*	0.01	0.01	0.01	1
Robinia pseudoacacia	0.01	0.01	0.01	1
Salvia lyrata	0.01	0.01	0.01	1
Scapania nemorea	0.01	0.01	0.01	1
Smilax herbacea	0.01	0.01	0.01	1
Solidago curtisii	0.01	0.01	0.01	1
Solidago flexicaulis	0.01	0.01	0.01	1
Symphyotrichum	0.01	0.01	0.01	1
Thalictrum clavatum	0.01	0.01	0.01	1
Uvularia grandiflora	0.01	0.01	0.01	1

American Water-willow Cobble Bar (CEGL004286) - 2 plots.

	% Cover			
Species	Mean	Min	Max	N
Justicia americana	22.5	5	40	2
Betula nigra	0.8	0.5	1	2
Physostegia virginiana ssp. *virginiana*	0.8	0.5	1	2
Platanus occidentalis	4.0	4	4	1
Carpinus caroliniana ssp. *virginiana*	0.5	0.5	0.5	1
Cephalanthus occidentalis	0.5	0.5	0.5	1
Salix caroliniana	0.5	0.5	0.5	1
Boehmeria cylindrica	0.01	0.01	0.01	1
Osmunda regalis var. *spectabilis*	0.01	0.01	0.01	1
Polygonum cuspidatum	0.01	0.01	0.01	1
Viola cucullata	0.01	0.01	0.01	1
Xanthium strumarium	0.01	0.01	0.01	1

Bur-reed Marsh (CEGL004510) - 1 plot.

	% Cover			
Species	Mean	Min	Max	N
Eleocharis acicularis var. *acicularis*	30.0	30	30	1
Sparganium chlorocarpum	20.0	20	20	1
Leersia oryzoides	10.0	10	10	1
Betula nigra	5.0	5	5	1
Sagittaria latifolia	5.0	5	5	1
Alisma subcordatum	1.0	1	1	1
Boehmeria cylindrica	1.0	1	1	1
Isoetes engelmannii	1.0	1	1	1
Ludwigia palustris	1.0	1	1	1
Lycopus virginicus	1.0	1	1	1
Lysimachia terrestris	1.0	1	1	1
Penthorum sedoides	1.0	1	1	1
Platanus occidentalis	1.0	1	1	1
Polygonum hydropiperoides	1.0	1	1	1
Bidens	0.5	0.5	0.5	1
Cornus amomum	0.5	0.5	0.5	1
Galium tinctorium	0.5	0.5	0.5	1
Juncus tenuis	0.5	0.5	0.5	1
Spiraea alba var. *alba*	0.5	0.5	0.5	1

Angelica triquinata	0.01	0.01	0.01	1
Apios americana	0.01	0.01	0.01	1
Carex crinita var. *crinita*	0.01	0.01	0.01	1
Carex lurida	0.01	0.01	0.01	1
Cinna arundinacea	0.01	0.01	0.01	1
Dichanthelium clandestinum	0.01	0.01	0.01	1
Eleocharis obtusa	0.01	0.01	0.01	1
Eupatorium perfoliatum var. *perfoliatum*	0.01	0.01	0.01	1
Hypericum mutilum	0.01	0.01	0.01	1
Impatiens capensis	0.01	0.01	0.01	1
Juncus effusus	0.01	0.01	0.01	1
Lilium superbum	0.01	0.01	0.01	1
Lysimachia ciliata	0.01	0.01	0.01	1
Lysimachia nummularia	0.01	0.01	0.01	1
Mimulus alatus	0.01	0.01	0.01	1
Prunella vulgaris	0.01	0.01	0.01	1
Ranunculus hispidus var. *nitidus*	0.01	0.01	0.01	1
Scirpus polyphyllus	0.01	0.01	0.01	1
Symphyotrichum	0.01	0.01	0.01	1
Triadenum	0.01	0.01	0.01	1

Cliff Top Virginia Pine Forest (CEGL007119) - 6 plots.

	% Cover			
Species	Mean	Min	Max	N
Pinus virginiana	47.5	30	60	6
Kalmia latifolia	7.0	0.5	25	6
Smilax rotundifolia	6.1	0.5	20	6
Oxydendrum arboreum	3.7	1	10	6
Quercus coccinea var. *coccinea*	2.8	0.5	7	6
Betula lenta	0.7	0.01	1	6
Vaccinium pallidum	3.6	1	10	5
Acer rubrum	2.9	0.5	7	5
Ilex opaca var. *opaca*	2.1	0.5	4	5
Tsuga canadensis	2.0	0.01	5	5
Cladonia caroliniana	2.0	1	5	5
Amelanchier arborea var. *arborea*	1.2	0.01	2	5
Gaultheria procumbens	1.0	0.5	2	5
Sassafras albidum	0.4	0.01	1	5
Leucobryum glaucum	4.8	1	10	4
Vaccinium stamineum	3.4	0.5	10	4
Quercus prinus	2.9	0.01	6	4
Quercus alba	2.0	0.01	5	4
Rhododendron maximum	2.0	0.01	6	4
Nyssa sylvatica	1.8	1	3	4
Smilax glauca	0.6	0.01	1	4
Epigaea repens	0.4	0.01	1	4
Gaylussacia baccata	20.3	1	40	3
Rhododendron catawbiense	2.3	1	5	3
Cladonia squamosa	0.7	0.5	1	3
Quercus rubra	0.2	0.01	0.5	3
Cladonia rangiferina	6.0	2	10	2
Lasallia papulosa	5.0	5	5	2
Leucobryum albidum	3.5	2	5	2
Dicranum scoparium	1.0	1	1	2
Polytrichum juniperinum	0.8	0.5	1	2
Umbilicaria mammulata	0.5	0.5	0.5	2
Danthonia spicata	0.3	0.01	0.5	2
Fagus grandifolia	0.3	0.01	0.5	2
Schizachyrium scoparium var. *scoparium*	0.3	0.01	0.5	2
Mitchella repens	0.0	0.01	0.01	2
Pinus rigida	23.0	23	23	1
Flavoparmelia caperata	3.0	3	3	1
Hypnum imponens	2.0	2	2	1
Castanea dentata	1.0	1	1	1
Cladonia	1.0	1	1	1
Dicranum condensatum	1.0	1	1	1
Dicranum spurium	1.0	1	1	1
Lasallia pensylvanica	1.0	1	1	1
Lycopodium tristachyum	1.0	1	1	1
Robinia pseudoacacia	1.0	1	1	1
Thuidium delicatulum	1.0	1	1	1
Betula alleghaniensis var. *alleghaniensis*	0.5	0.5	0.5	1
Carex pensylvanica	0.5	0.5	0.5	1
Cladonia pyxidata	0.5	0.5	0.5	1
Danthonia sericea	0.5	0.5	0.5	1
Dichanthelium commutatum ssp. *ashei*	0.5	0.5	0.5	1
Dicranum	0.5	0.5	0.5	1
Rubus	0.5	0.5	0.5	1
Solidago hispida var. *hispida*	0.5	0.5	0.5	1
Aralia spinosa	0.01	0.01	0.01	1
Asplenium montanum	0.01	0.01	0.01	1
Coreopsis major	0.01	0.01	0.01	1
Danthonia compressa	0.01	0.01	0.01	1

Dichanthelium acuminatum ssp. *columbianum*	0.01	0.01	0.01	1
Dichanthelium dichotomum ssp. *dichotomum*	0.01	0.01	0.01	1
Dichanthelium linearifolium	0.01	0.01	0.01	1
Hamamelis virginiana	0.01	0.01	0.01	1
Heuchera	0.01	0.01	0.01	1
Hieracium venosum	0.01	0.01	0.01	1
Hypericum hypericoides ssp. *multicaule*	0.01	0.01	0.01	1
Polytrichum	0.01	0.01	0.01	1
Quercus velutina	0.01	0.01	0.01	1
Xanthoparmelia conspersa	0.01	0.01	0.01	1
Xanthoparmelia plittii	0.01	0.01	0.01	1

Common Rock Tripe Cliff Face (CEGL004387) - 1 plot.

	% Cover			
Species	Mean	Min	Max	N
Umbilicaria mammulata	20.0	20	20	1
Andreaea rothii	5.0	5	5	1
Rhododendron maximum	2.0	2	2	1
Acer rubrum	1.0	1	1	1
Lepraria neglecta	1.0	1	1	1
Rhabdoweisia crispata	0.5	0.5	0.5	1
Tsuga canadensis	0.5	0.5	0.5	1
Kalmia latifolia	0.01	0.01	0.01	1
Leucobryum albidum	0.01	0.01	0.01	1
Magnolia acuminata	0.01	0.01	0.01	1
Oxydendrum arboreum	0.01	0.01	0.01	1
Rhododendron catawbiense	0.01	0.01	0.01	1
Vaccinium pallidum	0.01	0.01	0.01	1

Dry Cliff Face (CEGL006435) - 6 plots.

	% Cover			
Species	Mean	Min	Max	N
Umbilicaria mammulata	1.3	1	2	4
Rhododendron maximum	0.5	0.01	1	4
Betula lenta	0.1	0.01	0.5	4
Eurybia divaricata	0.0	0.01	0.01	4
Chrysothrix insulizans	7.5	5	10	2
Lepraria obscura	4.0	3	5	2
Lepraria lobificans	3.0	1	5	2
Leucobryum albidum	2.5	0.01	5	2
Andreaea rothii	1.5	0.01	3	2
Phlyctis petraea	1.5	1	2	2
Leucobryum glaucum	1.0	0.01	2	2
Acer rubrum	0.3	0.01	0.5	2
Polypodium virginianum	0.01	0.01	0.01	2
Viola	0.01	0.01	0.01	2
Cladonia squamosa	20.0	20	20	1
Cladonia rangiferina	10.0	10	10	1
Lichenothelia	5.0	5	5	1
Porpidia albocaerulescens	5.0	5	5	1
Cladonia	1.0	1	1	1
Lasallia papulosa	1.0	1	1	1
Lepraria caesiella	1.0	1	1	1
Leucolejeunea clypeata	1.0	1	1	1
Bazzania trilobata	0.5	0.5	0.5	1
Dryopteris intermedia	0.5	0.5	0.5	1
Fraxinus americana	0.5	0.5	0.5	1
Lepraria neglecta	0.5	0.5	0.5	1
Rhus	0.5	0.5	0.5	1
Rubus phoenicolasius	0.5	0.5	0.5	1
Tsuga canadensis	0.5	0.5	0.5	1
Acer pensylvanicum	0.01	0.01	0.01	1
Agrostis perennans	0.01	0.01	0.01	1
Amelanchier arborea var. *arborea*	0.01	0.01	0.01	1
Amphidium mougeotii	0.01	0.01	0.01	1
Andropogon gerardii	0.01	0.01	0.01	1
Arisaema triphyllum ssp. *triphyllum*	0.01	0.01	0.01	1
Asplenium montanum	0.01	0.01	0.01	1
Atrichum angustatum	0.01	0.01	0.01	1
Bryoandersonia illecebra	0.01	0.01	0.01	1
Carex	0.01	0.01	0.01	1
Carex communis var. *communis*	0.01	0.01	0.01	1
Carex digitalis var. *digitalis*	0.01	0.01	0.01	1
Carex swanii	0.01	0.01	0.01	1
Clethra acuminata	0.01	0.01	0.01	1
Coreopsis major	0.01	0.01	0.01	1
Cymophyllus fraserianus	0.01	0.01	0.01	1
Danthonia compressa	0.01	0.01	0.01	1
Dichanthelium dichotomum ssp. *dichotomum*	0.01	0.01	0.01	1
Dicranum fulvum	0.01	0.01	0.01	1
Dicranum scoparium	0.01	0.01	0.01	1

Diplophyllum apiculatum	0.01	0.01	0.01	1
Eupatorium godfreyanum	0.01	0.01	0.01	1
Heuchera americana var. *americana*	0.01	0.01	0.01	1
Heuchera villosa var. *villosa*	0.01	0.01	0.01	1
Ilex opaca var. *opaca*	0.01	0.01	0.01	1
Juniperus virginiana var. *virginiana*	0.01	0.01	0.01	1
Kalmia latifolia	0.01	0.01	0.01	1
Muhlenbergia sylvatica	0.01	0.01	0.01	1
Nyssa sylvatica	0.01	0.01	0.01	1
Parthenocissus quinquefolia	0.01	0.01	0.01	1
Phytolacca americana var. *americana*	0.01	0.01	0.01	1
Polygonatum biflorum	0.01	0.01	0.01	1
Polystichum acrostichoides	0.01	0.01	0.01	1
Polytrichum ohioense	0.01	0.01	0.01	1
Quercus prinus	0.01	0.01	0.01	1
Rubus	0.01	0.01	0.01	1
Schizachyrium scoparium var. *scoparium*	0.01	0.01	0.01	1
Sedum ternatum	0.01	0.01	0.01	1
Solidago	0.01	0.01	0.01	1
Thelypteris noveboracensis	0.01	0.01	0.01	1
Trillium erectum	0.01	0.01	0.01	1
Usnea amblyoclada	0.01	0.01	0.01	1
Vaccinium pallidum	0.01	0.01	0.01	1

Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest (CEGL008524) - 5 plots.

	% Cover			
Species	Mean	Min	Max	N
Tsuga canadensis	25.2	5	50	5
Rhododendron catawbiense	24.4	16	31	5
Quercus prinus	23.4	12	45	5
Rhododendron maximum	15.2	5	51	5
Acer rubrum	14.4	2	30	5
Oxydendrum arboreum	11.8	3	23	5
Smilax rotundifolia	1.7	0.5	4	5
Amelanchier arborea var. *arborea*	1.6	0.01	5	5
Quercus alba	11.8	1	25	4
Kalmia latifolia	8.3	2	20	4
Ilex opaca var. *opaca*	5.4	0.5	15	4
Hamamelis virginiana	1.9	0.5	5	4
Gaultheria procumbens	0.4	0.01	0.5	4
Leucobryum glaucum	0.3	0.01	0.5	4
Quercus coccinea var. *coccinea*	17.7	3	30	3
Quercus velutina	15.3	10	21	3
Sassafras albidum	2.5	0.5	5	3
Nyssa sylvatica	1.5	0.5	3	3
Hypnum imponens	0.3	0.01	1	3
Pinus virginiana	15.5	1	30	2
Carya alba	10.5	2	19	2
Fagus grandifolia	1.8	0.5	3	2
Vaccinium pallidum	1.3	0.5	2	2
Prunus serotina var. *serotina*	1.0	0.01	2	2
Ilex montana	0.5	0.01	1	2
Chimaphila maculata	0.5	0.5	0.5	2
Polypodium virginianum	0.5	0.5	0.5	2
Smilax glauca	0.3	0.01	0.5	2
Thuidium delicatulum	0.0	0.01	0.01	2
Cornus florida	2.0	2	2	1
Betula lenta	1.0	1	1	1
Castanea dentata	1.0	1	1	1
Cladonia uncialis	1.0	1	1	1
Dicranum scoparium	1.0	1	1	1
Quercus rubra	1.0	1	1	1
Asplenium platyneuron	0.5	0.5	0.5	1
Dryopteris intermedia	0.5	0.5	0.5	1
Epigaea repens	0.5	0.5	0.5	1
Hexastylis virginica	0.5	0.5	0.5	1
Leucobryum	0.5	0.5	0.5	1
Mitchella repens	0.5	0.5	0.5	1
Vaccinium stamineum	0.5	0.5	0.5	1
Viburnum acerifolium	0.5	0.5	0.5	1
Bazzania trilobata	0.01	0.01	0.01	1
Conopholis americana	0.01	0.01	0.01	1
Cypripedium acaule	0.01	0.01	0.01	1
Danthonia spicata	0.01	0.01	0.01	1
Euonymus americana	0.01	0.01	0.01	1
Goodyera pubescens	0.01	0.01	0.01	1
Heuchera	0.01	0.01	0.01	1
Juniperus virginiana var. *virginiana*	0.01	0.01	0.01	1
Magnolia acuminata	0.01	0.01	0.01	1
Polytrichum juniperinum	0.01	0.01	0.01	1
Umbilicaria mammulata	0.01	0.01	0.01	1

Eastern Hemlock Floodplain Forest (CEGL006620) - 11 plots.

Species	% Cover Mean	Min	Max	N
Tsuga canadensis	29.3	1	70	11
Rhododendron maximum	18.6	0.5	65	11
Acer rubrum	12.3	0.01	35	11
Hamamelis virginiana	2.2	0.5	6	10
Liriodendron tulipifera	10.2	0.5	30	9
Quercus rubra	10.9	0.01	30	8
Kalmia latifolia	6.0	0.01	35	8
Nyssa sylvatica	3.6	0.5	10	8
Xanthorhiza simplicissima	2.1	0.5	5	8
Thuidium delicatulum	1.4	0.01	5	8
Polystichum acrostichoides	0.7	0.01	3	8
Parthenocissus quinquefolia	0.5	0.01	2	8
Leucobryum glaucum	0.4	0.01	1	8
Betula lenta	18.6	3	40	7
Betula nigra	9.8	0.5	30	7
Fagus grandifolia	6.1	0.5	20	7
Ilex opaca var. *opaca*	2.4	0.01	10	7
Magnolia tripetala	1.8	0.01	6	7
Dryopteris intermedia	0.4	0.01	1	7
Mitchella repens	0.2	0.01	0.5	7
Oxydendrum arboreum	8.3	1	20	6
Eurybia divaricata	0.6	0.01	1	6
Euonymus americana	0.4	0.01	1	6
Viola	0.3	0.01	0.5	6
Carpinus caroliniana ssp. *virginiana*	6.9	0.5	12	5
Rubus	0.7	0.01	1	5
Smilax rotundifolia	0.6	0.5	1	5
Maianthemum racemosum ssp. *racemosum*	0.2	0.01	0.5	5
Thelypteris noveboracensis	2.8	0.01	5	4
Fraxinus pennsylvanica	2.3	0.01	3	4
Hypnum imponens	1.9	0.5	3	4
Amelanchier arborea var. *arborea*	0.9	0.01	2	4
Cornus florida	0.9	0.5	1	4
Carya cordiformis	0.4	0.01	1	4
Toxicodendron radicans	0.4	0.01	1	4
Anemone quinquefolia var. *quinquefolia*	0.4	0.01	0.5	4
Rudbeckia laciniata var. *laciniata*	0.1	0.01	0.5	4
Dicranum scoparium	17.3	0.01	51	3
Liquidambar styraciflua	10.7	2	15	3
Pinus rigida	6.3	5	8	3
Alnus serrulata	5.2	0.5	10	3
Betula alleghaniensis var. *alleghaniensis*	3.3	3	4	3
Magnolia fraseri	3.2	0.5	5	3
Chionanthus virginicus	2.8	0.5	7	3
Acer saccharum var. *saccharum*	1.3	0.01	3	3
Deschampsia flexuosa var. *flexuosa*	0.7	0.01	1	3
Maianthemum canadense	0.5	0.01	1	3
Bazzania trilobata	0.3	0.01	1	3
Polygonatum pubescens	0.3	0.01	1	3
Dichanthelium clandestinum	0.3	0.01	0.5	3
Lysimachia quadrifolia	0.3	0.01	0.5	3
Arisaema triphyllum ssp. *triphyllum*	0.2	0.01	0.5	3
Carex plantaginea	0.2	0.01	0.5	3
Osmunda regalis var. *spectabilis*	0.2	0.01	0.5	3
Vaccinium pallidum	0.2	0.01	0.5	3
Quercus prinus	10.0	0.01	20	2
Vaccinium corymbosum	3.0	1	5	2
Viburnum nudum var. *cassinoides*	2.3	0.5	4	2
Prunus serotina var. *serotina*	1.5	0.01	3	2
Erigeron pulchellus	1.0	0.01	2	2
Magnolia acuminata	1.0	1	1	2
Quercus alba	1.0	1	1	2
Ipomoea pandurata	0.8	0.5	1	2
Quercus	0.8	0.5	1	2
Pedicularis canadensis ssp. *canadensis*	0.5	0.01	1	2
Rosa multiflora	0.5	0.01	1	2
Zizia aptera	0.5	0.01	1	2
Acer pensylvanicum	0.5	0.5	0.5	2
Brachyelytrum erectum	0.5	0.5	0.5	2
Eupatorium rotundifolium var. *ovatum*	0.5	0.5	0.5	2
Smilax glauca	0.5	0.5	0.5	2

Solidago simplex ssp. *randii* var. *racemosa*	0.5	0.5	0.5	2
Cardamine diphylla	0.3	0.01	0.5	2
Dichanthelium polyanthes	0.3	0.01	0.5	2
Fraxinus americana	0.3	0.01	0.5	2
Hydrangea arborescens	0.3	0.01	0.5	2
Ilex montana	0.3	0.01	0.5	2
Packera aurea	0.3	0.01	0.5	2
Rosa carolina var. *carolina*	0.3	0.01	0.5	2
Smilax ecirrata	0.3	0.01	0.5	2
Smilax tamnoides	0.3	0.01	0.5	2
Viola blanda var. *blanda*	0.3	0.01	0.5	2
Carex	0.01	0.01	0.01	2
Crataegus	0.01	0.01	0.01	2
Dichanthelium laxiflorum	0.01	0.01	0.01	2
Goodyera pubescens	0.01	0.01	0.01	2
Hexastylis virginica	0.01	0.01	0.01	2
Monotropa uniflora	0.01	0.01	0.01	2
Quercus velutina	0.01	0.01	0.01	2
Sedum ternatum	0.01	0.01	0.01	2
Vitis	0.01	0.01	0.01	2
Robinia pseudoacacia	15.0	15	15	1
Hypericum prolificum	8.0	8	8	1
Lycopodium digitatum	5.0	5	5	1
Sassafras albidum	5.0	5	5	1
Physocarpus opulifolius var. *opulifolius*	3.0	3	3	1
Platanus occidentalis	3.0	3	3	1
Polygonum cuspidatum	3.0	3	3	1
Dennstaedtia punctilobula	2.0	2	2	1
Dichanthelium	2.0	2	2	1
Juniperus virginiana var. *virginiana*	2.0	2	2	1
Pteridium aquilinum	2.0	2	2	1
Rhododendron periclymenoides	2.0	2	2	1
Sorghastrum nutans	2.0	2	2	1
Vaccinium stamineum	2.0	2	2	1
Clethra acuminata	1.0	1	1	1
Houstonia serpyllifolia	1.0	1	1	1
Scapania nemorea	1.0	1	1	1
Schizachyrium scoparium var. *scoparium*	1.0	1	1	1
Andropogon gerardii	0.5	0.5	0.5	1
Aralia spinosa	0.5	0.5	0.5	1
Arnoglossum atriplicifolium	0.5	0.5	0.5	1
Asimina triloba	0.5	0.5	0.5	1
Baptisia tinctoria	0.5	0.5	0.5	1
Bryoandersonia illecebra	0.5	0.5	0.5	1
Castanea dentata	0.5	0.5	0.5	1
Chrysopsis mariana	0.5	0.5	0.5	1
Cladonia	0.5	0.5	0.5	1
Coreopsis major	0.5	0.5	0.5	1
Coreopsis tripteris	0.5	0.5	0.5	1
Cornus amomum	0.5	0.5	0.5	1
Cypripedium acaule	0.5	0.5	0.5	1
Danthonia compressa	0.5	0.5	0.5	1
Dichanthelium dichotomum	0.5	0.5	0.5	1
Dichanthelium dichotomum ssp. *microcarpon*	0.5	0.5	0.5	1
Dichanthelium ovale ssp. *villosissimum*	0.5	0.5	0.5	1
Dicranella	0.5	0.5	0.5	1
Dioscorea quaternata	0.5	0.5	0.5	1
Eupatorium album	0.5	0.5	0.5	1
Eupatorium fistulosum	0.5	0.5	0.5	1
Euphorbia corollata	0.5	0.5	0.5	1
Fraxinus	0.5	0.5	0.5	1
Helianthus strumosus	0.5	0.5	0.5	1
Hypericum hypericoides ssp. *multicaule*	0.5	0.5	0.5	1
Hypnum curvifolium	0.5	0.5	0.5	1
Hypoxis hirsuta	0.5	0.5	0.5	1
Ionactis linariifolius	0.5	0.5	0.5	1
Linum virginianum	0.5	0.5	0.5	1
Luzula acuminata	0.5	0.5	0.5	1
Lysimachia lanceolata	0.5	0.5	0.5	1
Medeola virginiana	0.5	0.5	0.5	1
Podophyllum peltatum	0.5	0.5	0.5	1
Polygonatum biflorum	0.5	0.5	0.5	1
Potentilla canadensis var. *canadensis*	0.5	0.5	0.5	1
Prunella vulgaris	0.5	0.5	0.5	1
Pyrularia pubera	0.5	0.5	0.5	1
Rhododendron arborescens	0.5	0.5	0.5	1
Sambucus	0.5	0.5	0.5	1
Smilax herbacea	0.5	0.5	0.5	1
Solidago bicolor	0.5	0.5	0.5	1
Solidago rugosa	0.5	0.5	0.5	1
Symphyotrichum	0.5	0.5	0.5	1
Symphyotrichum laeve	0.5	0.5	0.5	1
Symphyotrichum prenanthoides	0.5	0.5	0.5	1
Tephrosia virginiana	0.5	0.5	0.5	1
Trillium erectum	0.5	0.5	0.5	1

Uvularia sessilifolia	0.5	0.5	0.5	1
Viola pedata	0.5	0.5	0.5	1
Aesculus flava	0.01	0.01	0.01	1
Ageratina altissima var. *altissima*	0.01	0.01	0.01	1
Agrostis	0.01	0.01	0.01	1
Amelanchier	0.01	0.01	0.01	1
Amphicarpaea bracteata	0.01	0.01	0.01	1
Bidens	0.01	0.01	0.01	1
Carex communis var. *communis*	0.01	0.01	0.01	1
Carex swanii	0.01	0.01	0.01	1
Carya glabra	0.01	0.01	0.01	1
Chimaphila maculata	0.01	0.01	0.01	1
Clematis virginiana	0.01	0.01	0.01	1
Collinsonia canadensis	0.01	0.01	0.01	1
Dichanthelium dichotomum ssp. *dichotomum*	0.01	0.01	0.01	1
Elaeagnus umbellata var. *parvifolia*	0.01	0.01	0.01	1
Galium triflorum	0.01	0.01	0.01	1
Iris cristata	0.01	0.01	0.01	1
Leersia virginica	0.01	0.01	0.01	1
Lilium canadense	0.01	0.01	0.01	1
Lilium superbum	0.01	0.01	0.01	1
Lobelia cardinalis	0.01	0.01	0.01	1
Lobelia inflata	0.01	0.01	0.01	1
Lonicera japonica	0.01	0.01	0.01	1
Onoclea sensibilis	0.01	0.01	0.01	1
Osmorhiza claytonii	0.01	0.01	0.01	1
Polypodium virginianum	0.01	0.01	0.01	1
Pteridium aquilinum var. *latiusculum*	0.01	0.01	0.01	1
Sanguinaria canadensis	0.01	0.01	0.01	1
Smilax	0.01	0.01	0.01	1
Solidago caesia	0.01	0.01	0.01	1
Stellaria pubera	0.01	0.01	0.01	1
Tetraphis pellucida	0.01	0.01	0.01	1
Thalictrum	0.01	0.01	0.01	1
Thalictrum clavatum	0.01	0.01	0.01	1
Viburnum acerifolium	0.01	0.01	0.01	1

Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543) - 24 plots.

	% Cover			
Species	Mean	Min	Max	N
Tsuga canadensis	38.4	5	80	24
Rhododendron maximum	33.5	3	90	24
Acer rubrum	10.9	0.5	40	24
Betula lenta	9.1	0.01	40	22
Oxydendrum arboreum	4.4	0.01	15	18
Leucobryum glaucum	1.2	0.01	6	18
Magnolia fraseri	6.6	0.01	20	16
Liriodendron tulipifera	8.4	0.01	30	15
Thuidium delicatulum	2.3	0.01	7	15
Nyssa sylvatica	6.1	0.01	15	14
Hypnum imponens	1.2	0.01	8	14
Smilax rotundifolia	0.3	0.01	1	14
Quercus rubra	14.3	0.01	34	13
Ilex opaca var. *opaca*	2.1	0.01	11	13
Quercus prinus	16.7	2	65	12
Mitchella repens	0.2	0.01	1	12
Fagus grandifolia	9.8	0.01	45	11
Polystichum acrostichoides	0.5	0.01	1	11
Dryopteris intermedia	3.3	0.01	15	10
Sassafras albidum	2.3	0.01	15	10
Hamamelis virginiana	0.6	0.01	1	9
Rubus	0.2	0.01	0.5	9
Magnolia acuminata	1.6	0.01	5	8
Dryopteris marginalis	0.5	0.01	2	8
Quercus alba	4.6	0.01	15	7
Bazzania trilobata	1.9	0.01	5	7
Monotropa uniflora	0.1	0.01	0.5	7
Viola blanda var. *blanda*	0.7	0.01	3	6
Parthenocissus quinquefolia	0.4	0.01	1	6
Polypodium virginianum	0.4	0.01	1	6
Dicranum scoparium	2.5	0.5	7	5
Dicranum fulvum	2.3	0.5	5	5
Quercus velutina	1.6	0.01	5	5
Kalmia latifolia	1.0	0.01	3	5
Hexastylis virginica	0.4	0.01	1	5
Smilax glauca	0.3	0.01	0.5	5
Arisaema triphyllum ssp. *triphyllum*	0.1	0.01	0.5	5
Prunus serotina var. *serotina*	0.1	0.01	0.5	5
Acer saccharum var. *saccharum*	3.6	0.01	12	4

Thelypteris noveboracensis	2.0	0.01	7	4
Cypripedium acaule	0.1	0.01	0.5	4
Eurybia divaricata	0.1	0.01	0.5	4
Magnolia tripetala	3.5	0.5	5	3
Brotherella recurvans	1.3	0.01	3	3
Cornus florida	1.0	0.01	2	3
Amelanchier arborea var. *arborea*	0.7	0.01	1	3
Viburnum acerifolium	0.5	0.01	1	3
Conopholis americana	0.3	0.01	0.5	3
Polytrichum	0.3	0.01	0.5	3
Maianthemum racemosum ssp. *racemosum*	0.2	0.01	0.5	3
Toxicodendron radicans	0.2	0.01	0.5	3
Polygonatum pubescens	0.0	0.01	0.01	3
Betula alleghaniensis var. *alleghaniensis*	2.8	0.5	5	2
Fraxinus americana	1.5	0.01	3	2
Polytrichum pallidisetum	0.8	0.5	1	2
Viola	0.8	0.5	1	2
Vitis aestivalis	0.8	0.5	1	2
Euonymus americana	0.5	0.01	1	2
Hydrangea arborescens	0.5	0.01	1	2
Vitis	0.5	0.01	1	2
Dicranum	0.5	0.5	0.5	2
Asplenium platyneuron	0.3	0.01	0.5	2
Medeola virginiana	0.3	0.01	0.5	2
Solidago caesia	0.3	0.01	0.5	2
Umbilicaria mammulata	0.3	0.01	0.5	2
Acer pensylvanicum	0.01	0.01	0.01	2
Carya	0.01	0.01	0.01	2
Ilex montana	0.01	0.01	0.01	2
Pinus virginiana	20.0	20	20	1
Carya alba	7.0	7	7	1
Quercus coccinea var. *coccinea*	5.0	5	5	1
Leucobryum albidum	3.0	3	3	1
Castanea dentata	2.0	2	2	1
Tilia americana	2.0	2	2	1
Plagiomnium ellipticum	1.0	1	1	1
Steerecleus serrulatus	1.0	1	1	1
Aralia spinosa	0.5	0.5	0.5	1
Aristolochia macrophylla	0.5	0.5	0.5	1
Aulacomnium heterostichum	0.5	0.5	0.5	1
Clethra acuminata	0.5	0.5	0.5	1
Leucobryum	0.5	0.5	0.5	1
Loeskeobryum brevirostre	0.5	0.5	0.5	1
Maianthemum canadense	0.5	0.5	0.5	1
Monotropa hypopithys	0.5	0.5	0.5	1
Pylaisiadelpha tenuirostris	0.5	0.5	0.5	1
Robinia pseudoacacia	0.5	0.5	0.5	1
Sambucus nigra ssp. *canadensis*	0.5	0.5	0.5	1
Sambucus racemosa var. *racemosa*	0.5	0.5	0.5	1
Vaccinium pallidum	0.5	0.5	0.5	1
Vaccinium stamineum	0.5	0.5	0.5	1
Viola hastata	0.5	0.5	0.5	1
Viola sororia	0.5	0.5	0.5	1
Adiantum pedatum	0.01	0.01	0.01	1
Aristolochia serpentaria	0.01	0.01	0.01	1
Carex	0.01	0.01	0.01	1
Carex digitalis var. *digitalis*	0.01	0.01	0.01	1
Carex pensylvanica	0.01	0.01	0.01	1
Carya glabra	0.01	0.01	0.01	1
Chelone glabra	0.01	0.01	0.01	1
Chimaphila maculata	0.01	0.01	0.01	1
Cladonia	0.01	0.01	0.01	1
Dicranella	0.01	0.01	0.01	1
Dicranella heteromalla	0.01	0.01	0.01	1
Dioscorea quaternata	0.01	0.01	0.01	1
Ganoderma tsugae	0.01	0.01	0.01	1
Gaultheria procumbens	0.01	0.01	0.01	1
Geranium maculatum	0.01	0.01	0.01	1
Goodyera pubescens	0.01	0.01	0.01	1
Hedwigia ciliata	0.01	0.01	0.01	1
Heuchera	0.01	0.01	0.01	1
Impatiens	0.01	0.01	0.01	1
Lycopus uniflorus var. *uniflorus*	0.01	0.01	0.01	1
Mnium hornum	0.01	0.01	0.01	1
Ostrya virginiana var. *virginiana*	0.01	0.01	0.01	1
Panax quinquefolius	0.01	0.01	0.01	1
Poa cuspidata	0.01	0.01	0.01	1
Rhododendron	0.01	0.01	0.01	1
Russula	0.01	0.01	0.01	1
Sambucus	0.01	0.01	0.01	1
Solidago	0.01	0.01	0.01	1
Solidago hispida var. *hispida*	0.01	0.01	0.01	1
Thuidium	0.01	0.01	0.01	1
Tiarella cordifolia	0.01	0.01	0.01	1
Viburnum prunifolium	0.01	0.01	0.01	1

Viola rotundifolia	0.01	0.01	0.01	1
Xylaria magnoliae	0.01	0.01	0.01	1

Eastern Hemlock Plateau Forest (CEGL006304) - 8 plots.

Species	% Cover Mean	Min	Max	N
Tsuga canadensis	46.7	20	70	9
Liriodendron tulipifera	11.4	0.5	45	9
Polystichum acrostichoides	1.0	0.01	5	9
Acer rubrum	7.8	0.5	20	8
Quercus alba	6.3	0.01	30	8
Quercus rubra	4.4	0.01	10	7
Thuidium delicatulum	1.4	0.01	5	7
Ilex opaca var. *opaca*	0.5	0.01	1	7
Smilax rotundifolia	0.4	0.01	1	7
Fagus grandifolia	15.5	0.01	40	6
Acer saccharum var. *saccharum*	5.7	0.01	10	6
Thelypteris noveboracensis	2.4	0.01	10	6
Magnolia fraseri	0.7	0.01	3	6
Mitchella repens	0.3	0.01	0.5	6
Rubus	0.0	0.01	0.01	6
Prunus serotina var. *serotina*	1.1	0.01	5	5
Parthenocissus quinquefolia	0.3	0.01	0.5	5
Quercus prinus	6.3	0.01	15	4
Betula lenta	4.0	1	8	4
Nyssa sylvatica	3.1	0.01	10	4
Carya alba	2.0	0.01	3	4
Hypnum imponens	0.5	0.01	1	4
Dryopteris intermedia	0.3	0.01	0.5	4
Smilax glauca	0.3	0.01	0.5	4
Viola	0.3	0.01	0.5	4
Viburnum acerifolium	0.1	0.01	0.5	4
Viola hastata	0.1	0.01	0.5	4
Euonymus americana	0.01	0.01	0.01	4
Medeola virginiana	0.01	0.01	0.01	4
Quercus velutina	6.7	0.01	20	3
Conopholis americana	0.3	0.01	0.5	3
Dioscorea quaternata	0.3	0.01	0.5	3
Maianthemum racemosum ssp. *racemosum*	0.3	0.01	0.5	3
Carex digitalis var. *digitalis*	0.2	0.01	0.5	3
Goodyera pubescens	0.2	0.01	0.5	3
Magnolia acuminata	0.2	0.01	0.5	3
Leucobryum glaucum	0.01	0.01	0.01	3
Monotropa uniflora	0.01	0.01	0.01	3
Sassafras albidum	0.01	0.01	0.01	3
Carya glabra	10.5	1	20	2
Carya ovalis	1.0	0.01	2	2
Fraxinus americana	0.5	0.01	1	2
Dennstaedtia punctilobula	0.5	0.5	0.5	2
Eurybia divaricata	0.3	0.01	0.5	2
Geranium maculatum	0.3	0.01	0.5	2
Prenanthes	0.3	0.01	0.5	2
Vitis	0.3	0.01	0.5	2
Brachyelytrum erectum	0.01	0.01	0.01	2
Carex	0.01	0.01	0.01	2
Carya cordiformis	0.01	0.01	0.01	2
Chimaphila maculata	0.01	0.01	0.01	2
Cornus florida	0.01	0.01	0.01	2
Galium triflorum	0.01	0.01	0.01	2
Solidago caesia	0.01	0.01	0.01	2
Vaccinium pallidum	0.01	0.01	0.01	2
Carya	10.0	10	10	1
Dicranum fulvum	1.0	1	1	1
Leucobryum albidum	1.0	1	1	1
Ostrya virginiana var. *virginiana*	1.0	1	1	1
Oxydendrum arboreum	1.0	1	1	1
Phegopteris hexagonoptera	1.0	1	1	1
Stellaria pubera	1.0	1	1	1
Vitis aestivalis	1.0	1	1	1
Acer pensylvanicum	0.5	0.5	0.5	1
Galium lanceolatum	0.5	0.5	0.5	1
Leucobryum	0.5	0.5	0.5	1
Packera aurea	0.5	0.5	0.5	1
Polytrichum	0.5	0.5	0.5	1
Sedum ternatum	0.5	0.5	0.5	1
Toxicodendron radicans	0.5	0.5	0.5	1
Aesculus flava	0.01	0.01	0.01	1
Ageratina altissima var. *altissima*	0.01	0.01	0.01	1
Arisaema triphyllum ssp. *triphyllum*	0.01	0.01	0.01	1
Aristolochia macrophylla	0.01	0.01	0.01	1
Asimina triloba	0.01	0.01	0.01	1
Botrychium virginianum	0.01	0.01	0.01	1
Carex laxiflora	0.01	0.01	0.01	1
Carex radiata	0.01	0.01	0.01	1
Carpinus caroliniana ssp. *virginiana*	0.01	0.01	0.01	1
Cornus alternifolia	0.01	0.01	0.01	1
Dichanthelium	0.01	0.01	0.01	1
Epifagus virginiana	0.01	0.01	0.01	1

Galium circaezans var. *hypomalacum*	0.01	0.01	0.01	1
Galium latifolium	0.01	0.01	0.01	1
Hydrangea arborescens	0.01	0.01	0.01	1
Hypnum	0.01	0.01	0.01	1
Lactarius	0.01	0.01	0.01	1
Laportea canadensis	0.01	0.01	0.01	1
Packera obovata	0.01	0.01	0.01	1
Polygonatum biflorum	0.01	0.01	0.01	1
Polygonatum pubescens	0.01	0.01	0.01	1
Prosartes lanuginosa	0.01	0.01	0.01	1
Rhododendron maximum	0.01	0.01	0.01	1
Sanicula canadensis	0.01	0.01	0.01	1
Scutellaria elliptica var. *hirsuta*	0.01	0.01	0.01	1
Smilax tamnoides	0.01	0.01	0.01	1
Solidago bicolor	0.01	0.01	0.01	1
Verbesina occidentalis	0.01	0.01	0.01	1
Viola ×palmata	0.01	0.01	0.01	1
Viola blanda var. *blanda*	0.01	0.01	0.01	1
Viola hirsutula	0.01	0.01	0.01	1
Viola sororia	0.01	0.01	0.01	1
Viola striata	0.01	0.01	0.01	1

Forest Seep (CEGL007853) - 9 plots.

	% Cover			
Species	Mean	Min	Max	N
Acer rubrum	12.2	0.5	30	9
Thelypteris noveboracensis	9.0	1	25	9
Thuidium delicatulum	2.9	0.01	10	9
Polystichum acrostichoides	2.1	0.01	10	9
Athyrium filix-femina var. *angustum*	1.5	0.01	5	9
Liriodendron tulipifera	33.4	10	60	8
Betula lenta	6.7	0.5	10	8
Ilex opaca var. *opaca*	2.8	0.01	13	8
Tsuga canadensis	10.7	1	20	6
Fraxinus americana	9.2	0.01	40	6
Fagus grandifolia	6.2	0.01	30	6
Packera aurea	4.5	0.01	20	6
Viola cucullata	2.4	0.5	10	6
Chelone glabra	0.9	0.01	3	6
Plagiomnium ciliare	0.8	0.5	1	6
Parthenocissus quinquefolia	0.3	0.01	1	6
Eurybia divaricata	0.2	0.01	0.5	6
Quercus alba	7.4	0.01	20	5
Nyssa sylvatica	3.5	0.5	10	5
Quercus rubra	1.6	0.01	7	5
Rosa multiflora	0.8	0.01	2	5
Euonymus americana	0.2	0.01	0.5	5
Mitchella repens	0.2	0.01	0.5	5
Rubus	0.2	0.01	0.5	5
Carpinus caroliniana ssp. *virginiana*	20.3	1	40	4
Acer saccharum var. *saccharum*	10.8	1	23	4
Hypnum imponens	3.9	0.5	5	4
Toxicodendron radicans	1.0	0.01	3	4
Boehmeria cylindrica	1.0	0.5	2	4
Leersia virginica	1.0	0.5	2	4
Viola	0.4	0.01	1	4
Sambucus	0.4	0.01	0.5	4
Platanus occidentalis	8.3	5	15	3
Ulmus rubra	5.0	0.01	10	3
Carya alba	3.3	1	8	3
Osmunda cinnamomea	2.7	2	4	3
Viola blanda var. *blanda*	2.2	0.5	5	3
Asimina triloba	2.0	0.01	5	3
Onoclea sensibilis	0.7	0.01	2	3
Lycopus virginicus	0.7	0.01	1	3
Polygonum virginianum	0.7	0.5	1	3
Smilax rotundifolia	0.5	0.5	0.5	3
Polygonum caespitosum var. *longisetum*	0.3	0.01	1	3
Smilax glauca	0.3	0.01	1	3
Stellaria pubera	0.3	0.01	1	3
Carex debilis	0.3	0.01	0.5	3
Circaea lutetiana ssp. *canadensis*	0.3	0.01	0.5	3
Vitis aestivalis	0.3	0.01	0.5	3
Arisaema triphyllum ssp. *triphyllum*	0.2	0.01	0.5	3
Carex	0.2	0.01	0.5	3
Carex digitalis var. *digitalis*	0.2	0.01	0.5	3
Smilax tamnoides	0.2	0.01	0.5	3
Ageratina altissima var. *altissima*	0.01	0.01	0.01	3
Galium triflorum	0.01	0.01	0.01	3
Dennstaedtia punctilobula	15.5	1	30	2
Diarrhena americana	15.0	0.01	30	2
Lindera benzoin var. *pubescens*	3.8	0.5	7	2
Magnolia tripetala	3.5	1	6	2
Tiarella cordifolia	2.0	1	3	2
Hamamelis virginiana	1.0	0.01	2	2

Amphicarpaea bracteata	1.0	1	1	2
Pilea pumila var. *pumila*	1.0	1	1	2
Sedum ternatum	1.0	1	1	2
Glyceria striata	0.8	0.5	1	2
Osmorhiza claytonii	0.8	0.5	1	2
Rhododendron maximum	0.8	0.5	1	2
Verbesina alternifolia	0.8	0.5	1	2
Atrichum	0.5	0.01	1	2
Hydrophyllum canadense	0.5	0.01	1	2
Ilex verticillata	0.5	0.01	1	2
Lindera benzoin	0.5	0.01	1	2
Symphyotrichum prenanthoides	0.5	0.01	1	2
Anemone quinquefolia var. *quinquefolia*	0.3	0.01	0.5	2
Carex blanda	0.3	0.01	0.5	2
Carex swanii	0.3	0.01	0.5	2
Laportea canadensis	0.3	0.01	0.5	2
Leucobryum	0.3	0.01	0.5	2
Platanthera	0.3	0.01	0.5	2
Botrychium virginianum	0.01	0.01	0.01	2
Carex debilis var. *rudgei*	0.01	0.01	0.01	2
Carex laxiflora	0.01	0.01	0.01	2
Collinsonia canadensis	0.01	0.01	0.01	2
Dichanthelium clandestinum	0.01	0.01	0.01	2
Eupatorium purpureum var. *purpureum*	0.01	0.01	0.01	2
Geranium maculatum	0.01	0.01	0.01	2
Juncus	0.01	0.01	0.01	2
Medeola virginiana	0.01	0.01	0.01	2
Prenanthes	0.01	0.01	0.01	2
Sambucus nigra ssp. *canadensis*	0.01	0.01	0.01	2
Sanicula	0.01	0.01	0.01	2
Smilax	0.01	0.01	0.01	2
Solidago rugosa	0.01	0.01	0.01	2
Fraxinus	30.0	30	30	1
Osmunda claytoniana	30.0	30	30	1
Betula nigra	15.0	15	15	1
Rhododendron	7.0	7	7	1
Carex seorsa	5.0	5	5	1
Paulownia tomentosa	5.0	5	5	1
Bryoandersonia illecebra	3.0	3	3	1
Corylus americana	3.0	3	3	1
Scirpus	3.0	3	3	1
Alnus serrulata	1.0	1	1	1
Atrichum undulatum	1.0	1	1	1
Carex scabrata	1.0	1	1	1
Deparia acrostichoides	1.0	1	1	1
Dryopteris intermedia	1.0	1	1	1
Impatiens	1.0	1	1	1
Liquidambar styraciflua	1.0	1	1	1
Magnolia acuminata	1.0	1	1	1
Viola rotundifolia	1.0	1	1	1
Vitis	1.0	1	1	1
Atrichum angustatum	0.5	0.5	0.5	1
Carex baileyi	0.5	0.5	0.5	1
Carya	0.5	0.5	0.5	1
Cryptotaenia canadensis	0.5	0.5	0.5	1
Danthonia compressa	0.5	0.5	0.5	1
Dicranum	0.5	0.5	0.5	1
Dioscorea quaternata	0.5	0.5	0.5	1
Equisetum arvense	0.5	0.5	0.5	1
Festuca subverticillata	0.5	0.5	0.5	1
Juncus effusus	0.5	0.5	0.5	1
Kalmia latifolia	0.5	0.5	0.5	1
Leucobryum glaucum	0.5	0.5	0.5	1
Lindera benzoin var. *benzoin*	0.5	0.5	0.5	1
Oxydendrum arboreum	0.5	0.5	0.5	1
Polytrichum juniperinum	0.5	0.5	0.5	1
Potentilla simplex	0.5	0.5	0.5	1
Quercus velutina	0.5	0.5	0.5	1
Solidago caesia	0.5	0.5	0.5	1
Sphagnum palustre	0.5	0.5	0.5	1
Viola hastata	0.5	0.5	0.5	1
Viola pubescens	0.5	0.5	0.5	1
Amelanchier arborea var. *arborea*	0.01	0.01	0.01	1
Aulacomnium palustre	0.01	0.01	0.01	1
Betula	0.01	0.01	0.01	1
Boletus	0.01	0.01	0.01	1
Carex atlantica ssp. *atlantica*	0.01	0.01	0.01	1
Carex festucacea	0.01	0.01	0.01	1
Carex intumescens	0.01	0.01	0.01	1
Carex laxiculmis	0.01	0.01	0.01	1
Carex laxiculmis var. *laxiculmis*	0.01	0.01	0.01	1
Carex leptalea ssp. *leptalea*	0.01	0.01	0.01	1
Carex prasina	0.01	0.01	0.01	1
Carex radiata	0.01	0.01	0.01	1
Carya cordiformis	0.01	0.01	0.01	1
Clematis virginiana	0.01	0.01	0.01	1
Cornus	0.01	0.01	0.01	1
Dichanthelium	0.01	0.01	0.01	1

Dichanthelium laxiflorum	0.01	0.01	0.01	1
Epifagus virginiana	0.01	0.01	0.01	1
Eupatorium perfoliatum var. *perfoliatum*	0.01	0.01	0.01	1
Galium lanceolatum	0.01	0.01	0.01	1
Geum	0.01	0.01	0.01	1
Geum canadense var. *canadense*	0.01	0.01	0.01	1
Goodyera pubescens	0.01	0.01	0.01	1
Helianthus	0.01	0.01	0.01	1
Hieracium paniculatum	0.01	0.01	0.01	1
Hypericum punctatum	0.01	0.01	0.01	1
Luzula	0.01	0.01	0.01	1
Lycopus uniflorus var. *uniflorus*	0.01	0.01	0.01	1
Lysimachia quadrifolia	0.01	0.01	0.01	1
Magnolia fraseri	0.01	0.01	0.01	1
Maianthemum canadense	0.01	0.01	0.01	1
Monotropa uniflora	0.01	0.01	0.01	1
Osmunda regalis var. *spectabilis*	0.01	0.01	0.01	1
Oxypolis rigidior	0.01	0.01	0.01	1
Panax quinquefolius	0.01	0.01	0.01	1
Pellia epiphylla	0.01	0.01	0.01	1
Phegopteris hexagonoptera	0.01	0.01	0.01	1
Platanthera clavellata	0.01	0.01	0.01	1
Poa	0.01	0.01	0.01	1
Podophyllum peltatum	0.01	0.01	0.01	1
Polygonatum pubescens	0.01	0.01	0.01	1
Prunus serotina var. *serotina*	0.01	0.01	0.01	1
Ranunculus	0.01	0.01	0.01	1
Ranunculus hispidus var. *nitidus*	0.01	0.01	0.01	1
Rubus phoenicolasius	0.01	0.01	0.01	1
Rudbeckia laciniata var. *laciniata*	0.01	0.01	0.01	1
Sassafras albidum	0.01	0.01	0.01	1
Scutellaria lateriflora var. *lateriflora*	0.01	0.01	0.01	1
Thalictrum	0.01	0.01	0.01	1
Vaccinium pallidum	0.01	0.01	0.01	1

Oak / Ericad Forest (CEGL006271) - 10 plots.

	% Cover			
Species	Mean	Min	Max	N
Kalmia latifolia	21.6	0.5	50	10
Acer rubrum	9.7	1	20	10
Oxydendrum arboreum	6.0	0.5	20	10
Quercus velutina	17.1	0.5	41	9
Quercus alba	19.8	0.5	35	8
Quercus coccinea var. *coccinea*	16.6	0.5	40	8
Carya alba	4.9	0.5	20	8
Sassafras albidum	0.8	0.5	1	8
Smilax glauca	0.4	0.01	1	8
Leucobryum glaucum	0.4	0.01	1	8
Quercus prinus	18.4	3	50	7
Vaccinium pallidum	4.4	1	10	7
Nyssa sylvatica	2.1	0.01	5	7
Hamamelis virginiana	1.2	0.01	5	7
Smilax rotundifolia	1.0	0.5	3	7
Amelanchier arborea var. *arborea*	0.9	0.01	3	7
Liriodendron tulipifera	2.0	0.01	10	6
Thuidium delicatulum	1.2	0.01	5	6
Gaultheria procumbens	0.3	0.01	1	6
Betula lenta	5.0	1	11	5
Tsuga canadensis	3.8	0.01	10	5
Ilex opaca var. *opaca*	1.8	0.01	7	5
Cornus florida	1.2	0.5	3	5
Parthenocissus quinquefolia	0.5	0.01	1	5
Magnolia fraseri	12.0	3	20	4
Viburnum acerifolium	1.9	0.01	7	4
Polystichum acrostichoides	0.8	0.01	2	4
Coreopsis major	0.4	0.01	1	4
Polytrichum	0.1	0.01	0.5	4
Solidago caesia	0.1	0.01	0.5	4
Carex digitalis var. *digitalis*	0.01	0.01	0.01	4
Quercus rubra	4.5	0.5	10	3
Rhododendron maximum	3.0	1	5	3
Magnolia acuminata	1.8	0.5	4	3
Dicranum fulvum	0.8	0.5	1	3
Toxicodendron radicans	0.7	0.5	1	3
Dioscorea quaternata	0.5	0.5	0.5	3
Danthonia spicata	0.3	0.011	0.5	3
Dichanthelium dichotomum ssp. *dichotomum*	0.2	0.01	0.5	3

Hieracium venosum	0.2	0.01	0.5	3
Maianthemum racemosum ssp. *racemosum*	0.2	0.01	0.5	3
Chimaphila maculata	0.0	0.01	0.01	3
Lysimachia quadrifolia	0.0	0.01	0.01	3
Pinus rigida	11.5	8	15	2
Gaylussacia baccata	7.8	0.5	15	2
Robinia pseudoacacia	3.5	0.01	7	2
Pinus virginiana	2.0	0.01	4	2
Fagus grandifolia	2.0	1	3	2
Hypnum imponens	1.8	0.5	3	2
Flavoparmelia baltimorensis	1.5	1	2	2
Cladonia furcata	0.8	0.5	1	2
Hedwigia ciliata	0.8	0.5	1	2
Dichanthelium commutatum	0.5	0.01	1	2
Rhododendron calendulaceum	0.5	0.01	1	2
Potentilla simplex	0.5	0.5	0.5	2
Umbilicaria mammulata	0.5	0.5	0.5	2
Asplenium platyneuron	0.3	0.01	0.5	2
Carex communis var. *communis*	0.3	0.01	0.5	2
Helianthus	0.3	0.01	0.5	2
Hypericum hypericoides ssp. *multicaule*	0.3	0.01	0.5	2
Ilex montana	0.3	0.01	0.5	2
Polytrichum ohioense	0.3	0.01	0.5	2
Potentilla canadensis var. *canadensis*	0.3	0.01	0.5	2
Rubus	0.3	0.01	0.5	2
Scutellaria elliptica var. *hirsuta*	0.3	0.01	0.5	2
Castanea dentata	0.01	0.01	0.01	2
Conopholis americana	0.01	0.01	0.01	2
Cypripedium acaule	0.01	0.01	0.01	2
Goodyera pubescens	0.01	0.01	0.01	2
Houstonia longifolia	0.01	0.01	0.01	2
Lespedeza	0.01	0.01	0.01	2
Smilax tamnoides	0.01	0.01	0.01	2
Solidago	0.01	0.01	0.01	2
Viola hastata	0.01	0.01	0.01	2
Carya glabra	10.01	10	10	1
Vaccinium stamineum	10.0	10	10	1
Betula alleghaniensis var. *alleghaniensis*	5.0	5	5	1
Leucobryum albidum	3.0	3	3	1
Dicranum scoparium	2.0	2	2	1
Dryopteris marginalis	2.0	2	2	1
Acer saccharum var. *saccharum*	1.0	1	1	1
Castanea	1.0	1	1	1
Epigaea repens	1.0	1	1	1
Punctelia rudecta	1.0	1	1	1
Vitis	1.0	1	1	1
Acer pensylvanicum	0.5	0.5	0.5	1
Antennaria plantaginifolia	0.5	0.5	0.5	1
Antennaria solitaria	0.5	0.5	0.5	1
Cornus alternifolia	0.5	0.5	0.5	1
Dichanthelium commutatum ssp. *ashei*	0.5	0.5	0.5	1
Dryopteris intermedia	0.5	0.5	0.5	1
Eupatorium godfreyanum	0.5	0.5	0.5	1
Eurybia divaricata	0.5	0.5	0.5	1
Flavoparmelia caperata	0.5	0.5	0.5	1
Hieracium paniculatum	0.5	0.5	0.5	1
Hypnum	0.5	0.5	0.5	1
Lactuca	0.5	0.5	0.5	1
Lespedeza frutescens	0.5	0.5	0.5	1
Lobelia inflata	0.5	0.5	0.5	1
Pinus strobus	0.5	0.5	0.5	1
Polytrichum juniperinum	0.5	0.5	0.5	1
Rhus copallinum	0.5	0.5	0.5	1
Sambucus racemosa var. *racemosa*	0.5	0.5	0.5	1
Symphyotrichum	0.5	0.5	0.5	1
Ageratina altissima var. *altissima*	0.01	0.01	0.01	1
Aralia racemosa ssp. *racemosa*	0.01	0.01	0.01	1
Arisaema triphyllum ssp. *triphyllum*	0.01	0.01	0.01	1
Aureolaria flava	0.01	0.01	0.01	1
Aureolaria virginica	0.01	0.01	0.01	1
Carex laxiflora	0.01	0.01	0.01	1
Carex pensylvanica	0.01	0.01	0.01	1
Carex virescens	0.01	0.01	0.01	1
Cunila origanoides	0.01	0.01	0.01	1
Danthonia	0.01	0.01	0.01	1
Danthonia sericea	0.01	0.01	0.01	1
Desmodium nudiflorum	0.01	0.01	0.01	1
Dichanthelium	0.01	0.01	0.01	1
Dichanthelium boscii	0.01	0.01	0.01	1
Dichanthelium laxiflorum	0.01	0.01	0.01	1
Dicranum	0.01	0.01	0.01	1
Eupatorium	0.01	0.01	0.01	1
Eurybia	0.01	0.01	0.01	1

Frullania asagrayana	0.01	0.01	0.01	1
Galium lanceolatum	0.01	0.01	0.01	1
Heuchera	0.01	0.01	0.01	1
Hydrangea arborescens	0.01	0.01	0.01	1
Hypoxis hirsuta	0.01	0.01	0.01	1
Leucobryum	0.01	0.01	0.01	1
Mitchella repens	0.01	0.01	0.01	1
Monotropa hypopithys	0.01	0.01	0.01	1
Monotropa uniflora	0.01	0.01	0.01	1
Mutinus elegans	0.01	0.01	0.01	1
Pinus	0.01	0.01	0.01	1
Poa cuspidata	0.01	0.01	0.01	1
Polygonatum biflorum	0.01	0.01	0.01	1
Porteranthus trifoliatus	0.01	0.01	0.01	1
Prenanthes	0.01	0.01	0.01	1
Prunus serotina var. *serotina*	0.01	0.01	0.01	1
Pteridium aquilinum	0.01	0.01	0.01	1
Ranunculus recurvatus var. *recurvatus*	0.01	0.01	0.01	1
Rhododendron	0.01	0.01	0.01	1
Sericocarpus asteroides	0.01	0.01	0.01	1
Solidago bicolor	0.01	0.01	0.01	1
Stellaria pubera	0.01	0.01	0.01	1
Viola	0.01	0.01	0.01	1
Viola ×palmata	0.01	0.01	0.01	1

Oak / Great Laurel Forest (CEGL006286) - 7 plots.

	% Cover			
Species	Mean	Min	Max	N
Rhododendron maximum	30.7	5	90	7
Quercus prinus	19.1	5	35	7
Acer rubrum	14.0	3	35	7
Quercus rubra	13.7	0.01	27	6
Betula lenta	10.7	0.01	45	6
Thuidium delicatulum	2.8	0.01	10	6
Smilax rotundifolia	0.5	0.01	1	6
Nyssa sylvatica	6.2	3	10	5
Kalmia latifolia	5.6	1	15	5
Tsuga canadensis	5.3	0.5	10	5
Oxydendrum arboreum	3.0	1	8	5
Parthenocissus quinquefolia	2.6	0.01	11	5
Sassafras albidum	1.3	0.01	5	5
Fagus grandifolia	9.8	2	20	4
Quercus velutina	9.3	5	15	4
Quercus alba	7.8	0.01	14	4
Liriodendron tulipifera	5.3	0.01	15	4
Rubus	1.5	0.01	5	4
Magnolia fraseri	1.3	0.01	3	4
Hamamelis virginiana	1.1	0.01	3	4
Ilex opaca var. *opaca*	1.1	0.01	2	4
Polystichum acrostichoides	1.0	0.01	3	4
Leucobryum glaucum	0.9	0.01	3	4
Maianthemum racemosum ssp. *racemosum*	0.1	0.01	0.5	4
Dicranum fulvum	4.2	0.5	10	3
Carya alba	2.0	0.01	3	3
Dryopteris marginalis	1.2	0.01	3	3
Dioscorea quaternata	0.3	0.01	0.5	3
Mitchella repens	0.2	0.01	0.5	3
Viburnum acerifolium	0.2	0.01	0.5	3
Chimaphila maculata	0.01	0.01	0.01	3
Euonymus americana	0.01	0.01	0.01	3
Eurybia divaricata	0.01	0.01	0.01	3
Smilax glauca	0.01	0.01	0.01	3
Solidago caesia	0.01	0.01	0.01	3
Quercus coccinea var. *coccinea*	4.0	1	7	2
Toxicodendron radicans	3.0	1	5	2
Vitis	2.0	1	3	2
Hypnum imponens	1.5	0.01	3	2
Magnolia tripetala	0.8	0.5	1	2
Acer pensylvanicum	0.5	0.01	1	2
Arisaema triphyllum ssp. *triphyllum*	0.3	0.01	0.5	2
Carex laxiflora	0.3	0.01	0.5	2
Conopholis americana	0.3	0.01	0.5	2
Dryopteris intermedia	0.3	0.01	0.5	2
Leucobryum albidum	0.3	0.01	0.5	2
Aralia spinosa	0.01	0.01	0.01	2
Carex communis var. *communis*	0.01	0.01	0.01	2
Dichanthelium commutatum ssp. *commutatum*	0.01	0.01	0.01	2
Heuchera americana var. *americana*	0.01	0.01	0.01	2
Monotropa uniflora	0.01	0.01	0.01	2
Viola hastata	0.01	0.01	0.01	2
Carya ovata	5.0	5	5	1
Fraxinus pennsylvanica	5.0	5	5	1
Rubus occidentalis	3.0	3	3	1
Populus grandidentata	2.0	2	2	1
Acer saccharum var. *saccharum*	1.0	1	1	1
Viola blanda var. *blanda*	1.0	1	1	1

Carex	0.5	0.5	0.5	1
Cercis canadensis var. *canadensis*	0.5	0.5	0.5	1
Cladonia cylindrica	0.5	0.5	0.5	1
Fraxinus americana	0.5	0.5	0.5	1
Leucobryum	0.5	0.5	0.5	1
Ostrya virginiana var. *virginiana*	0.5	0.5	0.5	1
Polytrichum pallidisetum	0.5	0.5	0.5	1
Ribes	0.5	0.5	0.5	1
Rosa multiflora	0.5	0.5	0.5	1
Rubus odoratus var. *odoratus*	0.5	0.5	0.5	1
Rubus phoenicolasius	0.5	0.5	0.5	1
Amelanchier arborea var. *arborea*	0.01	0.01	0.01	1
Asplenium platyneuron	0.01	0.01	0.01	1
Carex blanda	0.01	0.01	0.01	1
Carex willdenowii	0.01	0.01	0.01	1
Carya	0.01	0.01	0.01	1
Dennstaedtia punctilobula	0.01	0.01	0.01	1
Dichanthelium dichotomum	0.01	0.01	0.01	1
Galium circaezans	0.01	0.01	0.01	1
Galium triflorum	0.01	0.01	0.01	1
Gaultheria procumbens	0.01	0.01	0.01	1
Geum canadense var. *canadense*	0.01	0.01	0.01	1
Helianthus	0.01	0.01	0.01	1
Hexastylis virginica	0.01	0.01	0.01	1
Ilex montana	0.01	0.01	0.01	1
Lysimachia quadrifolia	0.01	0.01	0.01	1
Phryma leptostachya	0.01	0.01	0.01	1
Phytolacca americana var. *americana*	0.01	0.01	0.01	1
Poa cuspidata	0.01	0.01	0.01	1
Polygonatum biflorum	0.01	0.01	0.01	1
Potentilla simplex	0.01	0.01	0.01	1
Prenanthes	0.01	0.01	0.01	1
Rhododendron catawbiense	0.01	0.01	0.01	1
Solidago arguta	0.01	0.01	0.01	1
Umbilicaria mammulata	0.01	0.01	0.01	1
Viola	0.01	0.01	0.01	1
Viola sagittata	0.01	0.01	0.01	1
Viola sororia	0.01	0.01	0.01	1
Vitis aestivalis	0.01	0.01	0.01	1
Xylaria magnoliae	0.01	0.01	0.01	1

Oak - Hickory Floodplain Forest (CEGL006462) - 1 plot.

	% Cover			
Species	Mean	Min	Max	N
Thelypteris noveboracensis	40.0	40	40	1
Liriodendron tulipifera	30.0	30	30	1
Quercus alba	30.0	30	30	1
Quercus velutina	25.0	25	25	1
Magnolia tripetala	15.0	15	15	1
Carya alba	12.0	12	12	1
Magnolia acuminata	10.0	10	10	1
Magnolia fraseri	10.0	10	10	1
Sassafras albidum	10.0	10	10	1
Carpinus caroliniana ssp. *virginiana*	4.0	4	4	1
Hamamelis virginiana	3.0	3	3	1
Ilex opaca var. *opaca*	3.0	3	3	1
Chionanthus virginicus	2.0	2	2	1
Hexastylis virginica	2.0	2	2	1
Maianthemum racemosum ssp. *racemosum*	2.0	2	2	1
Oxydendrum arboreum	2.0	2	2	1
Smilax rotundifolia	2.0	2	2	1
Acer rubrum	1.0	1	1	1
Asimina triloba	1.0	1	1	1
Euonymus americana	1.0	1	1	1
Quercus prinus	1.0	1	1	1
Arisaema triphyllum ssp. *triphyllum*	0.5	0.5	0.5	1
Brachyelytrum erectum	0.5	0.5	0.5	1
Castanea	0.5	0.5	0.5	1
Conopholis americana	0.5	0.5	0.5	1
Crataegus	0.5	0.5	0.5	1
Fraxinus	0.5	0.5	0.5	1
Osmunda cinnamomea	0.5	0.5	0.5	1
Parthenocissus quinquefolia	0.5	0.5	0.5	1
Polygonatum biflorum	0.5	0.5	0.5	1
Rubus	0.5	0.5	0.5	1
Sanguinaria canadensis	0.5	0.5	0.5	1
Vaccinium stamineum	0.5	0.5	0.5	1
Viburnum acerifolium	0.5	0.5	0.5	1
Viola	0.5	0.5	0.5	1
Vitis	0.5	0.5	0.5	1
Xanthorhiza simplicissima	0.5	0.5	0.5	1
Dioscorea quaternata	0.01	0.01	0.01	1
Geranium maculatum	0.01	0.01	0.01	1

Menispermum canadense	0.01	0.01	0.01	1
Podophyllum peltatum	0.01	0.01	0.01	1
Sambucus nigra ssp. *canadensis*	0.01	0.01	0.01	1
Silene stellata	0.01	0.01	0.01	1
Uvularia perfoliata	0.01	0.01	0.01	1

Oak - Hickory Forest (CEGL007267) - 23 plots.

	% Cover			
Species	Mean	Min	Max	N
Acer rubrum	15.4	0.01	31	23
Smilax rotundifolia	1.6	0.01	11	21
Liriodendron tulipifera	10.0	0.01	30	19
Quercus alba	14.9	0.01	60	18
Carya alba	13.5	0.5	60	18
Polystichum acrostichoides	2.1	0.01	10	18
Parthenocissus quinquefolia	1.6	0.01	10	18
Nyssa sylvatica	5.6	0.01	20	16
Acer saccharum var. *saccharum*	5.4	0.01	15	16
Rubus	0.7	0.01	7	16
Carex digitalis var. *digitalis*	0.2	0.01	0.5	16
Oxydendrum arboreum	6.3	0.5	20	15
Thuidium delicatulum	2.2	0.01	10	15
Sassafras albidum	0.9	0.01	6	15
Dioscorea quaternata	0.8	0.01	8	15
Smilax glauca	0.4	0.01	1	15
Quercus prinus	13.5	2	46	14
Fagus grandifolia	9.9	0.5	45	14
Quercus rubra	8.7	0.5	30	14
Toxicodendron radicans	1.6	0.01	10	14
Quercus velutina	17.1	0.5	35	13
Magnolia acuminata	3.3	0.01	10	13
Cornus florida	1.6	0.01	5	13
Solidago caesia	0.3	0.01	0.5	13
Viburnum acerifolium	1.3	0.01	5	12
Hamamelis virginiana	2.5	0.01	7	11
Prunus serotina var. *serotina*	1.4	0.01	10	11
Dichanthelium boscii	0.3	0.01	1	11
Maianthemum racemosum ssp. *racemosum*	0.1	0.01	0.5	11
Vaccinium pallidum	1.8	0.01	8	10
Ilex opaca var. *opaca*	0.8	0.01	2	10
Leucobryum glaucum	0.7	0.01	3	10
Tsuga canadensis	6.0	0.01	10	9
Fraxinus americana	2.1	0.01	6	9
Viola hastata	0.2	0.01	1	9
Desmodium nudiflorum	0.2	0.01	0.5	9
Eurybia divaricata	0.2	0.01	0.5	9
Potentilla simplex	0.2	0.01	0.5	9
Carex communis var. *communis*	0.2	0.01	0.5	9
Quercus coccinea var. *coccinea*	14.9	5	40	8
Magnolia fraseri	8.1	0.01	30	8
Cercis canadensis var. *canadensis*	1.3	0.01	4	8
Ageratina altissima var. *altissima*	0.6	0.01	3	8
Amelanchier arborea var. *arborea*	0.2	0.01	0.5	8
Galium circaezans var. *hypomalacum*	0.1	0.01	0.5	8
Arisaema triphyllum ssp. *triphyllum*	0.1	0.01	0.5	8
Betula lenta	9.4	0.01	30	7
Vitis aestivalis	0.9	0.01	3	7
Phryma leptostachya	0.5	0.01	2	7
Carex laxiflora	0.3	0.01	0.5	7
Mitchella repens	0.1	0.01	0.5	7
Scutellaria elliptica var. *hirsuta*	0.1	0.01	0.5	7
Goodyera pubescens	0.01	0.01	0.01	7
Robinia pseudoacacia	3.1	0.5	5	6
Dryopteris intermedia	2.7	0.01	10	6
Euonymus americana	0.4	0.01	1	6
Viola	0.4	0.01	1	6
Vitis	0.3	0.01	1	6
Prenanthes	0.2	0.01	0.5	6
Carex radiata	0.1	0.01	0.5	6
Carex swanii	0.1	0.01	0.5	6
Polygonatum biflorum	0.1	0.01	0.5	6
Monotropa uniflora	0.01	0.01	0.01	6
Thelypteris noveboracensis	3.8	0.01	10	5
Dryopteris marginalis	2.2	0.5	5	5
Hypnum imponens	1.4	0.5	3	5
Kalmia latifolia	0.9	0.5	2	5
Vaccinium stamineum	0.5	0.01	1	5
Tilia americana	0.4	0.01	2	5
Carex willdenowii	0.1	0.01	0.5	5
Chimaphila maculata	0.1	0.01	0.5	5
Galium triflorum	0.1	0.01	0.5	5
Carya glabra	10.8	6	20	4
Rhododendron maximum	4.1	0.5	10	4
Amphicarpaea bracteata	1.4	0.01	5	4
Polytrichum ohioense	1.1	0.5	3	4

Potentilla canadensis var. *canadensis*	0.6	0.5	1	4
Brachyelytrum erectum	0.5	0.5	0.5	4
Ostrya virginiana var. *virginiana*	0.5	0.5	0.5	4
Rubus occidentalis	0.5	0.5	0.5	4
Hieracium paniculatum	0.4	0.01	0.5	4
Viola ×palmata	0.4	0.01	0.5	4
Dichanthelium dichotomum ssp. *dichotomum*	0.3	0.01	0.5	4
Rosa multiflora	0.3	0.01	0.5	4
Viola sagittata	0.3	0.01	0.5	4
Helianthus	0.1	0.01	0.5	4
Rosa carolina var. *carolina*	0.1	0.01	0.5	4
Asplenium platyneuron	0.01	0.01	0.01	4
Actaea racemosa var. *racemosa*	2.0	0.01	5	3
Dicranum fulvum	1.0	0.01	2	3
Carpinus caroliniana ssp. *virginiana*	0.8	0.5	1	3
Magnolia tripetala	0.7	0.01	1	3
Danthonia spicata	0.7	0.5	1	3
Coreopsis major	0.5	0.5	0.5	3
Packera obovata	0.5	0.5	0.5	3
Aristolochia macrophylla	0.3	0.01	1	3
Acer pensylvanicum	0.3	0.01	0.5	3
Leucobryum albidum	0.3	0.01	0.5	3
Corylus americana	0.2	0.01	0.5	3
Hieracium venosum	0.2	0.01	0.5	3
Hydrangea arborescens	0.2	0.01	0.5	3
Osmorhiza claytonii	0.2	0.01	0.5	3
Solidago	0.2	0.01	0.5	3
Conopholis americana	0.01	0.01	0.01	3
Cynoglossum virginianum var. *virginianum*	0.01	0.01	0.01	3
Epifagus virginiana	0.01	0.01	0.01	3
Lobelia inflata	0.01	0.01	0.01	3
Paronychia canadensis	0.01	0.01	0.01	3
Stellaria pubera	0.01	0.01	0.01	3
Flavoparmelia baltimorensis	13.0	1	25	2
Rubus odoratus var. *odoratus*	3.0	1	5	2
Flavoparmelia caperata	2.8	0.5	5	2
Carya ovata	2.5	0.01	5	2
Aralia spinosa	0.8	0.5	1	2
Desmodium	0.8	0.5	1	2
Phytolacca americana var. *americana*	0.8	0.5	1	2
Actaea	0.5	0.5	0.5	2
Antennaria plantaginifolia	0.5	0.5	0.5	2
Gaultheria procumbens	0.5	0.5	0.5	2
Viola hirsutula	0.5	0.5	0.5	2
Ambrosia artemisiifolia var. *elatior*	0.3	0.01	0.5	2
Carex virescens	0.3	0.01	0.5	2
Desmodium paniculatum var. *paniculatum*	0.3	0.01	0.5	2
Galium circaezans var. *circaezans*	0.3	0.01	0.5	2
Juncus tenuis	0.3	0.01	0.5	2
Laportea canadensis	0.3	0.01	0.5	2
Poa	0.3	0.01	0.5	2
Poa cuspidata	0.3	0.01	0.5	2
Polypodium virginianum	0.3	0.01	0.5	2
Punctelia rudecta	0.3	0.01	0.5	2
Solidago arguta	0.3	0.01	0.5	2
Solidago curtisii	0.3	0.01	0.5	2
Viola blanda var. *blanda*	0.3	0.01	0.5	2
Aristolochia serpentaria	0.01	0.01	0.01	2
Carex	0.01	0.01	0.01	2
Carex blanda	0.01	0.01	0.01	2
Cornus	0.01	0.01	0.01	2
Crataegus	0.01	0.01	0.01	2
Dichanthelium commutatum ssp. *ashei*	0.01	0.01	0.01	2
Dichanthelium dichotomum	0.01	0.01	0.01	2
Hypericum hypericoides ssp. *multicaule*	0.01	0.01	0.01	2
Lysimachia quadrifolia	0.01	0.01	0.01	2
Polygonatum pubescens	0.01	0.01	0.01	2
Porteranthus trifoliatus	0.01	0.01	0.01	2
Ranunculus recurvatus var. *recurvatus*	0.01	0.01	0.01	2
Sedum ternatum	0.01	0.01	0.01	2
Pinus rigida	5.0	5	5	1
Brachythecium salebrosum	3.0	3	3	1
Carya	3.0	3	3	1

Dicranum scoparium	3.0	3	3	1
Hedwigia ciliata	2.0	2	2	1
Juglans nigra	2.0	2	2	1
Rubus flagellaris	2.0	2	2	1
Adlumia fungosa	1.0	1	1	1
Athyrium filix-femina var. *angustum*	1.0	1	1	1
Castanea dentata	1.0	1	1	1
Dennstaedtia punctilobula	1.0	1	1	1
Elaeagnus umbellata var. *parvifolia*	1.0	1	1	1
Packera aurea	1.0	1	1	1
Polymnia canadensis	1.0	1	1	1
Umbilicaria mammulata	1.0	1	1	1
Agrimonia rostellata	0.5	0.5	0.5	1
Agrostis perennans	0.5	0.5	0.5	1
Ailanthus altissima	0.5	0.5	0.5	1
Asclepias tuberosa ssp. *tuberosa*	0.5	0.5	0.5	1
Betula alleghaniensis var. *alleghaniensis*	0.5	0.5	0.5	1
Bromus pubescens	0.5	0.5	0.5	1
Cladonia	0.5	0.5	0.5	1
Cunila origanoides	0.5	0.5	0.5	1
Dicranum flagellare	0.5	0.5	0.5	1
Dicranum fuscescens	0.5	0.5	0.5	1
Festuca subverticillata	0.5	0.5	0.5	1
Geranium maculatum	0.5	0.5	0.5	1
Geum virginianum	0.5	0.5	0.5	1
Grimmia pilifera	0.5	0.5	0.5	1
Helianthus divaricatus	0.5	0.5	0.5	1
Hexastylis virginica	0.5	0.5	0.5	1
Hieracium caespitosum	0.5	0.5	0.5	1
Impatiens	0.5	0.5	0.5	1
Lactuca	0.5	0.5	0.5	1
Leucobryum	0.5	0.5	0.5	1
Lolium pratense	0.5	0.5	0.5	1
Luzula multiflora ssp. *multiflora* var. *multiflora*	0.5	0.5	0.5	1
Medeola virginiana	0.5	0.5	0.5	1
Monarda clinopodia	0.5	0.5	0.5	1
Myelochroa aurulenta	0.5	0.5	0.5	1
Oxalis grandis	0.5	0.5	0.5	1
Poa compressa	0.5	0.5	0.5	1
Prunus pensylvanica var. *pensylvanica*	0.5	0.5	0.5	1
Rhus copallinum	0.5	0.5	0.5	1
Sambucus nigra ssp. *canadensis*	0.5	0.5	0.5	1
Sericocarpus asteroides	0.5	0.5	0.5	1
Silene virginica var. *virginica*	0.5	0.5	0.5	1
Solidago arguta var. *arguta*	0.5	0.5	0.5	1
Solidago flexicaulis	0.5	0.5	0.5	1
Solidago hispida var. *hispida*	0.5	0.5	0.5	1
Ulmus rubra	0.5	0.5	0.5	1
Ulota hutchinsiae	0.5	0.5	0.5	1
Viola pubescens	0.5	0.5	0.5	1
Agrimonia striata	0.01	0.01	0.01	1
Arabis laevigata var. *laevigata*	0.01	0.01	0.01	1
Arabis canadensis	0.01	0.01	0.01	1
Arnoglossum atriplicifolium	0.01	0.01	0.01	1
Asclepias quadrifolia	0.01	0.01	0.01	1
Aureolaria	0.01	0.01	0.01	1
Botrychium dissectum	0.01	0.01	0.01	1
Botrychium virginianum	0.01	0.01	0.01	1
Brachythecium plumosum	0.01	0.01	0.01	1
Carex laxiculmis	0.01	0.01	0.01	1
Carex rosea	0.01	0.01	0.01	1
Circaea lutetiana ssp. *canadensis*	0.01	0.01	0.01	1
Collinsonia canadensis	0.01	0.01	0.01	1
Crepis pulchra	0.01	0.01	0.01	1
Desmodium glutinosum	0.01	0.01	0.01	1
Dichanthelium clandestinum	0.01	0.01	0.01	1
Dichanthelium commutatum	0.01	0.01	0.01	1
Dichanthelium commutatum ssp. *commutatum*	0.01	0.01	0.01	1
Dichanthelium latifolium	0.01	0.01	0.01	1
Dichanthelium laxiflorum	0.01	0.01	0.01	1
Dichanthelium polyanthes	0.01	0.01	0.01	1
Dicranella	0.01	0.01	0.01	1
Dicranum	0.01	0.01	0.01	1
Eupatorium godfreyanum	0.01	0.01	0.01	1
Eupatorium purpureum var. *purpureum*	0.01	0.01	0.01	1
Galium circaezans	0.01	0.01	0.01	1
Heuchera americana var. *americana*	0.01	0.01	0.01	1
Houstonia longifolia	0.01	0.01	0.01	1

Lactuca canadensis	0.01	0.01	0.01	1
Lespedeza procumbens	0.01	0.01	0.01	1
Luzula	0.01	0.01	0.01	1
Luzula echinata	0.01	0.01	0.01	1
Morus rubra var. *rubra*	0.01	0.01	0.01	1
Oxalis violacea	0.01	0.01	0.01	1
Panax quinquefolius	0.01	0.01	0.01	1
Pedicularis canadensis ssp. *canadensis*	0.01	0.01	0.01	1
Pilea pumila var. *pumila*	0.01	0.01	0.01	1
Plagiomnium cuspidatum	0.01	0.01	0.01	1
Polygonum virginianum	0.01	0.01	0.01	1
Polytrichum	0.01	0.01	0.01	1
Prosartes lanuginosa	0.01	0.01	0.01	1
Rhododendron calendulaceum	0.01	0.01	0.01	1
Sambucus	0.01	0.01	0.01	1
Sambucus racemosa var. *racemosa*	0.01	0.01	0.01	1
Sanicula	0.01	0.01	0.01	1
Sanicula canadensis	0.01	0.01	0.01	1
Sanicula canadensis var. *grandis*	0.01	0.01	0.01	1
Sanicula marilandica	0.01	0.01	0.01	1
Silene	0.01	0.01	0.01	1
Smilax tamnoides	0.01	0.01	0.01	1
Solidago roanensis	0.01	0.01	0.01	1
Sphenopholis nitida	0.01	0.01	0.01	1
Symphyotrichum	0.01	0.01	0.01	1
Symphyotrichum patens var. *patens*	0.01	0.01	0.01	1
Symphyotrichum undulatum	0.01	0.01	0.01	1
Verbena urticifolia	0.01	0.01	0.01	1
Verbesina alternifolia	0.01	0.01	0.01	1
Viola rotundifolia	0.01	0.01	0.01	1
Viola sororia	0.01	0.01	0.01	1
Viola triloba var. *triloba*	0.01	0.01	0.01	1

Oak - Hickory - Sugar Maple Forest (CEGL007268) - 12 plots.

	% Cover			
Species	Mean	Min	Max	N
Acer saccharum var. *saccharum*	26.6	10	60	12
Quercus rubra	17.5	0.5	40	12
Parthenocissus quinquefolia	2.3	0.01	15	12
Dioscorea quaternata	0.4	0.01	0.5	12
Polystichum acrostichoides	3.3	0.5	20	11
Smilax rotundifolia	0.8	0.01	3	11
Quercus prinus	10.9	0.01	35	10
Eurybia divaricata	0.6	0.01	1	10
Toxicodendron radicans	1.7	0.01	6	9
Solidago caesia	0.7	0.01	1	9
Galium circaezans var. *hypomalacum*	0.1	0.01	0.5	9
Quercus alba	15.6	0.01	30	8
Fagus grandifolia	7.8	1	15	8
Acer rubrum	6.5	1	11	8
Cercis canadensis var. *canadensis*	2.5	0.5	11	8
Fraxinus americana	2.4	0.01	12	8
Carex laxiflora	0.3	0.01	0.5	8
Nyssa sylvatica	3.0	0.5	10	7
Prunus serotina var. *serotina*	2.7	0.01	10	7
Ostrya virginiana var. *virginiana*	1.2	0.01	4	7
Cornus florida	1.0	0.01	2	7
Viburnum acerifolium	0.6	0.01	2	7
Ageratina altissima var. *altissima*	0.2	0.01	0.5	7
Maianthemum racemosum ssp. *racemosum*	0.1	0.01	0.5	7
Carya glabra	20.7	10	30	6
Quercus velutina	17.9	0.01	47	6
Carya alba	9.9	0.5	30	6
Sassafras albidum	6.2	0.01	30	6
Dichanthelium boscii	0.6	0.5	1	6
Arisaema triphyllum ssp. *triphyllum*	0.4	0.01	1	6
Brachyelytrum erectum	0.3	0.01	1	6
Hydrangea arborescens	0.3	0.01	0.5	6
Smilax glauca	0.3	0.01	0.5	6
Carex digitalis var. *digitalis*	0.2	0.01	0.5	6
Desmodium nudiflorum	0.2	0.01	0.5	6

Scutellaria elliptica var. *hirsuta*	0.1	0.01	0.5	6
Thuidium delicatulum	3.4	0.5	8	5
Sedum ternatum	2.4	0.01	10	5
Tilia americana	1.6	0.01	5	5
Vitis aestivalis	0.7	0.01	1	5
Tsuga canadensis	0.7	0.5	1	5
Poa cuspidata	0.4	0.01	1	5
Rubus	0.3	0.01	0.5	5
Euonymus americana	0.2	0.01	0.5	5
Geranium maculatum	0.2	0.01	0.5	5
Phryma leptostachya	0.1	0.01	0.5	5
Prosartes lanuginosa	0.01	0.01	0.01	5
Liriodendron tulipifera	9.4	0.5	15	4
Carya ovata	5.8	3	10	4
Amelanchier arborea var. *arborea*	1.1	0.01	2	4
Dryopteris marginalis	0.6	0.01	1	4
Antennaria plantaginifolia	0.4	0.01	0.5	4
Magnolia acuminata	0.4	0.01	0.5	4
Asclepias quadrifolia	0.3	0.01	0.5	4
Asplenium platyneuron	0.1	0.01	0.5	4
Stellaria pubera	0.1	0.01	0.5	4
Prenanthes	0.01	0.01	0.01	4
Betula lenta	10.3	1	25	3
Oxydendrum arboreum	3.7	0.01	10	3
Ilex opaca var. *opaca*	3.3	0.01	7	3
Acer pensylvanicum	2.7	0.01	6	3
Hamamelis virginiana	1.0	0.01	2	3
Robinia pseudoacacia	0.7	0.01	1	3
Amphicarpaea bracteata	0.3	0.01	0.5	3
Bromus pubescens	0.3	0.01	0.5	3
Cunila origanoides	0.3	0.01	0.5	3
Solidago curtisii	0.3	0.01	0.5	3
Actaea	0.2	0.01	0.5	3
Botrychium virginianum	0.2	0.01	0.5	3
Laportea canadensis	0.2	0.01	0.5	3
Rosa carolina var. *carolina*	0.2	0.01	0.5	3
Galium lanceolatum	0.01	0.01	0.01	3
Goodyera pubescens	0.01	0.01	0.01	3
Helianthus divaricatus	0.01	0.01	0.01	3
Diarrhena americana	35.5	1	70	2
Carpinus caroliniana ssp. *virginiana*	8.0	5	11	2
Magnolia fraseri	4.5	3	6	2
Cornus alternifolia	0.5	0.01	1	2
Dryopteris intermedia	0.5	0.01	1	2
Packera obovata	0.5	0.01	1	2

Aristolochia serpentaria	0.5	0.5	0.5	2
Potentilla canadensis var. *canadensis*	0.5	0.5	0.5	2
Symphyotrichum	0.5	0.5	0.5	2
Ulmus rubra	0.5	0.5	0.5	2
Aristolochia macrophylla	0.3	0.01	0.5	2
Carex communis var. *communis*	0.3	0.01	0.5	2
Collinsonia canadensis	0.3	0.01	0.5	2
Conopholis americana	0.3	0.01	0.5	2
Galium circaezans	0.3	0.01	0.5	2
Helianthus	0.3	0.01	0.5	2
Hieracium venosum	0.3	0.01	0.5	2
Leucobryum albidum	0.3	0.01	0.5	2
Phytolacca americana var. *americana*	0.3	0.01	0.5	2
Smilax tamnoides	0.3	0.01	0.5	2
Viola	0.3	0.01	0.5	2
Viola triloba var. *triloba*	0.3	0.01	0.5	2
Carex blanda	0.01	0.01	0.01	2
Carya cordiformis	0.01	0.01	0.01	2
Chimaphila maculata	0.01	0.01	0.01	2
Galium triflorum	0.01	0.01	0.01	2
Geum	0.01	0.01	0.01	2
Hieracium paniculatum	0.01	0.01	0.01	2
Houstonia longifolia	0.01	0.01	0.01	2
Muhlenbergia	0.01	0.01	0.01	2
Phegopteris hexagonoptera	0.01	0.01	0.01	2
Viola sagittata	0.01	0.01	0.01	2
Carya ovalis	15.0	15	15	1
Lindera benzoin	13.0	13	13	1
Juglans nigra	5.0	5	5	1
Platanus occidentalis	5.0	5	5	1
Brachythecium laetum	3.0	3	3	1
Viola rotundifolia	3.0	3	3	1
Dicranum fulvum	2.0	2	2	1
Dicranum scoparium	2.0	2	2	1
Aesculus flava	1.0	1	1	1
Castanea dentata	1.0	1	1	1
Elymus hystrix var. *hystrix*	1.0	1	1	1
Viola rostrata	1.0	1	1	1
Vitis	1.0	1	1	1
Actaea racemosa var. *racemosa*	0.5	0.5	0.5	1
Adiantum pedatum	0.5	0.5	0.5	1
Cardamine hirsuta	0.5	0.5	0.5	1
Carex pensylvanica	0.5	0.5	0.5	1
Climacium americanum	0.5	0.5	0.5	1

Desmodium glutinosum	0.5	0.5	0.5	1
Dichanthelium dichotomum ssp. *dichotomum*	0.5	0.5	0.5	1
Gaultheria procumbens	0.5	0.5	0.5	1
Hypnum imponens	0.5	0.5	0.5	1
Kalmia latifolia	0.5	0.5	0.5	1
Leucobryum glaucum	0.5	0.5	0.5	1
Pilea pumila var. *pumila*	0.5	0.5	0.5	1
Poa	0.5	0.5	0.5	1
Poa compressa	0.5	0.5	0.5	1
Polygonatum pubescens	0.5	0.5	0.5	1
Polygonum	0.5	0.5	0.5	1
Polygonum scandens	0.5	0.5	0.5	1
Polygonum virginianum	0.5	0.5	0.5	1
Polymnia canadensis	0.5	0.5	0.5	1
Polytrichum	0.5	0.5	0.5	1
Sambucus racemosa var. *racemosa*	0.5	0.5	0.5	1
Silene virginica var. *virginica*	0.5	0.5	0.5	1
Solidago hispida var. *hispida*	0.5	0.5	0.5	1
Solidago roanensis	0.5	0.5	0.5	1
Taenidia integerrima	0.5	0.5	0.5	1
Thalictrum thalictroides	0.5	0.5	0.5	1
Tiarella cordifolia	0.5	0.5	0.5	1
Vaccinium pallidum	0.5	0.5	0.5	1
Vaccinium stamineum	0.5	0.5	0.5	1
Viola striata	0.5	0.5	0.5	1
Acalypha virginica	0.01	0.01	0.01	1
Adiantum pedatum	0.01	0.01	0.01	1
Agrimonia rostellata	0.01	0.01	0.01	1
Agrostis perennans	0.01	0.01	0.01	1
Arabis canadensis	0.01	0.01	0.01	1
Arabis laevigata var. *laevigata*	0.01	0.01	0.01	1
Athyrium filix-femina	0.01	0.01	0.01	1
Carex	0.01	0.01	0.01	1
Carex rosea	0.01	0.01	0.01	1
Caulophyllum thalictroides	0.01	0.01	0.01	1
Corylus americana	0.01	0.01	0.01	1
Dichanthelium	0.01	0.01	0.01	1
Dichanthelium commutatum ssp. *ashei*	0.01	0.01	0.01	1
Dichanthelium dichotomum	0.01	0.01	0.01	1
Eurybia	0.01	0.01	0.01	1
Heuchera	0.01	0.01	0.01	1
Heuchera americana var. *americana*	0.01	0.01	0.01	1
Hydrastis canadensis	0.01	0.01	0.01	1
Hypericum punctatum	0.01	0.01	0.01	1
Lactuca	0.01	0.01	0.01	1
Lindera benzoin var. *pubescens*	0.01	0.01	0.01	1
Luzula	0.01	0.01	0.01	1
Medeola virginiana	0.01	0.01	0.01	1
Mitchella repens	0.01	0.01	0.01	1
Monarda	0.01	0.01	0.01	1
Morus rubra var. *rubra*	0.01	0.01	0.01	1
Osmorhiza claytonii	0.01	0.01	0.01	1
Oxalis grandis	0.01	0.01	0.01	1
Paronychia canadensis	0.01	0.01	0.01	1
Passiflora lutea	0.01	0.01	0.01	1
Polygonatum biflorum	0.01	0.01	0.01	1
Polygonum convolvulus var. *convolvulus*	0.01	0.01	0.01	1
Pyrularia pubera	0.01	0.01	0.01	1
Rhododendron maximum	0.01	0.01	0.01	1
Rosa multiflora	0.01	0.01	0.01	1
Sanguinaria canadensis	0.01	0.01	0.01	1
Sanicula	0.01	0.01	0.01	1
Silene stellata	0.01	0.01	0.01	1
Solidago	0.01	0.01	0.01	1
Solidago arguta	0.01	0.01	0.01	1
Symphyotrichum patens var. *patens*	0.01	0.01	0.01	1
Symphyotrichum undulatum	0.01	0.01	0.01	1
Thalictrum	0.01	0.01	0.01	1
Thelypteris noveboracensis	0.01	0.01	0.01	1

Riverscour Shrub Prairie (CEGL006623) - 27 plots.

Species	% Cover Mean	Min	Max	N
Betula nigra	6.9	0.01	20	25
Andropogon gerardii	8.7	0.5	30	24
Solidago simplex ssp. *randii* var. *racemosa*	2.5	0.5	8	23
Packera paupercula	1.5	0.01	5	22
Physocarpus opulifolius var. *opulifolius*	1.5	0.01	10	20
Symphyotrichum laeve var. *concinnum*	0.9	0.01	3	20
Ilex verticillata	1.9	0.01	9	19
Eupatorium fistulosum	0.6	0.01	1	18
Platanus occidentalis	2.5	0.01	10	16
Cornus amomum	2.2	0.01	6	16
Dichanthelium clandestinum	0.4	0.01	2	15
Ipomoea pandurata	1.4	0.01	3	14
Rosa carolina var. *carolina*	0.8	0.01	2	14
Sorghastrum nutans	4.4	0.01	15	13
Schizachyrium scoparium var. *scoparium*	2.2	0.01	5	13
Euphorbia corollata	0.6	0.01	1	13
Clematis virginiana	0.5	0.01	1	13
Physostegia virginiana ssp. *virginiana*	3.0	0.01	15	12
Hypericum prolificum	2.1	0.5	10	12
Osmunda regalis var. *spectabilis*	0.8	0.01	2	12
Viola pedata	0.9	0.01	4	11
Rubus	0.6	0.01	2	11
Hypoxis hirsuta	0.5	0.01	1	11
Viola	0.5	0.01	0.5	11
Panicum virgatum	3.8	0.5	15	10
Nyssa sylvatica	2.5	0.5	10	10
Diospyros virginiana	1.8	0.5	5	10
Alnus serrulata	1.3	0.01	5	10
Trautvetteria caroliniensis var. *caroliniensis*	1.3	0.5	4	10
Rhododendron arborescens	1.1	0.01	5	10
Potentilla canadensis var. *canadensis*	0.8	0.5	2	10
Lysimachia lanceolata	0.7	0.01	1	10
Dichanthelium dichotomum	0.5	0.01	1	10
Deschampsia flexuosa var. *flexuosa*	0.4	0.01	0.5	10
Justicia americana	1.7	0.01	8	9
Cephalanthus occidentalis	1.4	0.01	4	9
Xanthorhiza simplicissima	0.5	0.01	1	9
Lobelia cardinalis	0.4	0.01	0.5	9
Salix caroliniana	1.8	0.01	7	8
Toxicodendron radicans	0.6	0.01	1	8
Boehmeria cylindrica	0.5	0.01	1	8
Helenium autumnale var. *autumnale*	0.4	0.01	0.5	8
Houstonia serpyllifolia	0.4	0.01	1	8
Ionactis linariifolius	0.4	0.01	0.5	8
Tsuga canadensis	2.9	0.5	7	7
Chionanthus virginicus	0.8	0.5	1	7
Acer rubrum	0.7	0.5	2	7
Linum virginianum	0.6	0.5	1	7
Tephrosia virginiana	0.5	0.01	1	7
Hypericum mutilum	0.4	0.01	1	7
Liatris scariosa var. *scariosa*	0.4	0.01	0.5	7
Symphyotrichum prenanthoides	0.3	0.01	0.5	7
Viburnum nudum var. *cassinoides*	1.1	0.5	3	6
Smilax glauca	0.7	0.5	1	6
Zizia aptera	0.7	0.5	1	6
Dichanthelium dichotomum ssp. *dichotomum*	0.6	0.01	1	6
Dichanthelium polyanthes	0.6	0.5	1	6
Rudbeckia laciniata var. *laciniata*	0.5	0.01	1	6
Coreopsis tripteris	0.4	0.01	1	6
Lespedeza cuneata	0.4	0.01	0.5	6
Viola cucullata	0.3	0.01	1	6
Polystichum acrostichoides	0.3	0.01	0.5	6
Juniperus virginiana var. *virginiana*	5.5	0.5	20	5
Hamamelis virginiana	1.6	0.5	5	5
Vaccinium corymbosum	1.2	0.5	3	5
Rosa multiflora	0.7	0.01	1	5
Symphyotrichum lanceolatum	0.6	0.01	1	5
Houstonia caerulea	0.5	0.5	0.5	5
Smilax herbacea	0.5	0.5	0.5	5
Dichanthelium acuminatum ssp. *fasciculatum*	0.4	0.01	0.5	5
Marshallia grandiflora	0.4	0.01	0.5	5

Rhynchospora capitellata	0.3	0.01	1	5
Potentilla simplex	0.3	0.01	0.5	5
Baptisia tinctoria	1.4	0.5	3	4
Hypericum hypericoides ssp. *multicaule*	0.8	0.5	1	4
Iris	0.8	0.5	1	4
Dichanthelium	0.6	0.01	1	4
Chrysopsis mariana	0.6	0.5	1	4
Solidago rugosa	0.4	0.01	1	4
Carex torta	0.4	0.01	0.5	4
Linum striatum	0.4	0.01	0.5	4
Smilax rotundifolia	0.4	0.01	0.5	4
Spiraea virginiana	4.2	0.5	10	3
Apocynum cannabinum	3.8	0.5	10	3
Rhododendron maximum	1.2	0.01	3	3
Porella pinnata	1.2	0.5	2	3
Rubus flagellaris	0.7	0.01	1	3
Carex pensylvanica	0.7	0.5	1	3
Hedwigia ciliata	0.7	0.5	1	3
Lysimachia quadrifolia	0.7	0.5	1	3
Symphyotrichum lateriflorum	0.7	0.5	1	3
Climacium americanum	0.5	0.01	1	3
Eurybia divaricata	0.5	0.01	1	3
Carex	0.3	0.01	1	3
Agrostis perennans	0.3	0.01	0.5	3
Coreopsis major	0.3	0.01	0.5	3
Euthamia graminifolia var. *graminifolia*	0.3	0.01	0.5	3
Pedicularis canadensis ssp. *canadensis*	0.3	0.01	0.5	3
Phlox maculata ssp. *pyramidalis*	0.3	0.01	0.5	3
Ranunculus hispidus var. *nitidus*	0.3	0.01	0.5	3
Thalictrum	0.3	0.01	0.5	3
Viola ×primulifolia	0.3	0.01	0.5	3
Leersia oryzoides	0.2	0.01	0.5	3
Lycopus uniflorus var. *uniflorus*	0.2	0.01	0.5	3
Packera aurea	0.2	0.01	0.5	3
Juncus tenuis	0.01	0.01	0.01	2
Polygonum caespitosum var. *longisetum*	0.01	0.01	0.01	3
Prunella vulgaris	0.01	0.01	0.01	3
Vaccinium pallidum	0.01	0.01	0.01	3
Prunus pumila var. *susquehanae*	25.0	25	25	2
Liquidambar styraciflua	5.3	0.5	10	2
Kalmia latifolia	2.5	0.01	5	2
Lolium arundinaceum	2.5	0.01	5	2
Ilex opaca var. *opaca*	2.3	0.5	4	2
Sematophyllum demissum	1.8	0.5	3	2
Campylopus tallulensis	1.0	0.01	2	2
Onoclea sensibilis	1.0	0.01	2	2
Fagus grandifolia	0.8	0.5	1	2
Mimulus ringens var. *ringens*	0.8	0.5	1	2
Pinus rigida	0.8	0.5	1	2
Quercus alba	0.8	0.5	1	2
Rhododendron periclymenoides	0.8	0.5	1	2
Salix nigra	0.8	0.5	1	2
Elaeagnus umbellata var. *parvifolia*	0.5	0.01	1	2
Agrostis	0.5	0.5	0.5	2
Bryum	0.5	0.5	0.5	2
Erigeron pulchellus	0.5	0.5	0.5	2
Muhlenbergia tenuiflora	0.5	0.5	0.5	2
Pinus virginiana	0.5	0.5	0.5	2
Quercus	0.5	0.5	0.5	2
Solanum carolinense var. *carolinense*	0.5	0.5	0.5	2
Ambrosia artemisiifolia var. *elatior*	0.3	0.01	0.5	2
Grimmia laevigata	0.3	0.01	0.5	2
Hypericum densiflorum	0.3	0.01	0.5	2
Leersia virginica	0.3	0.01	0.5	2
Lindernia dubia var. *dubia*	0.3	0.01	0.5	2
Eleocharis obtusa	0.01	0.01	0.01	2
Eleocharis tenuis	0.01	0.01	0.01	2
Eupatorium perfoliatum var. *perfoliatum*	0.01	0.01	0.01	2
Fissidens osmundioides	0.01	0.01	0.01	2
Ludwigia palustris	0.01	0.01	0.01	2
Muhlenbergia sylvatica	0.01	0.01	0.01	2
Penthorum sedoides	0.01	0.01	0.01	2
Plantago rugelii var. *rugelii*	0.01	0.01	0.01	2
Scirpus cyperinus	0.01	0.01	0.01	2
Scirpus polyphyllus	0.01	0.01	0.01	2
Xanthoparmelia conspersa	10.0	10	10	1
Dicranum	5.0	5	5	1

Campsis radicans	3.0	3	3	1
Solidago juncea var. *juncea*	3.0	3	3	1
Betula lenta	2.0	2	2	1
Asclepias incarnata ssp. *pulchra*	1.0	1	1	1
Aster	1.0	1	1	1
Euonymus americana	1.0	1	1	1
Phlox maculata ssp. *maculata*	1.0	1	1	1
Pteridium aquilinum var. *latiusculum*	1.0	1	1	1
Salix alba	1.0	1	1	1
Sphagnum lescurii	1.0	1	1	1
Viburnum acerifolium	1.0	1	1	1
Acalypha rhomboidea	0.5	0.5	0.5	1
Amelanchier arborea var. *arborea*	0.5	0.5	0.5	1
Atrichum undulatum	0.5	0.5	0.5	1
Bidens coronata	0.5	0.5	0.5	1
Bidens frondosa	0.5	0.5	0.5	1
Carya alba	0.5	0.5	0.5	1
Cornus florida	0.5	0.5	0.5	1
Dichanthelium acuminatum ssp. *implicatum*	0.5	0.5	0.5	1
Dichanthelium commutatum	0.5	0.5	0.5	1
Doellingeria umbellata var. *umbellata*	0.5	0.5	0.5	1
Entodon seductrix	0.5	0.5	0.5	1
Eupatorium	0.5	0.5	0.5	1
Eupatorium purpureum var. *purpureum*	0.5	0.5	0.5	1
Eurybia	0.5	0.5	0.5	1
Fraxinus pennsylvanica	0.5	0.5	0.5	1
Hygrohypnum eugyrium	0.5	0.5	0.5	1
Hypericum perforatum	0.5	0.5	0.5	1
Hypericum punctatum	0.5	0.5	0.5	1
Hypnum curvifolium	0.5	0.5	0.5	1
Lespedeza	0.5	0.5	0.5	1
Lonicera morrowii	0.5	0.5	0.5	1
Lycopus	0.5	0.5	0.5	1
Lycopus virginicus	0.5	0.5	0.5	1
Lysimachia nummularia	0.5	0.5	0.5	1
Lysimachia terrestris	0.5	0.5	0.5	1
Mitchella repens	0.5	0.5	0.5	1
Muhlenbergia frondosa	0.5	0.5	0.5	1
Packera obovata	0.5	0.5	0.5	1
Panicum	0.5	0.5	0.5	1
Panicum dichotomiflorum ssp. *dichotomiflorum*	0.5	0.5	0.5	1
Polygala senega	0.5	0.5	0.5	1
Potentilla	0.5	0.5	0.5	1
Racomitrium aciculare	0.5	0.5	0.5	1
Rhododendron calendulaceum	0.5	0.5	0.5	1
Robinia pseudoacacia	0.5	0.5	0.5	1
Schoenoplectus tabernaemontani	0.5	0.5	0.5	1
Scirpus atrovirens	0.5	0.5	0.5	1
Solidago bicolor	0.5	0.5	0.5	1
Thelypteris noveboracensis	0.5	0.5	0.5	1
Vernonia	0.5	0.5	0.5	1
Vernonia gigantea ssp. *gigantea*	0.5	0.5	0.5	1
Anthoxanthum odoratum ssp. *odoratum*	0.01	0.01	0.01	1
Bidens vulgata	0.01	0.01	0.01	1
Boykinia aconitifolia	0.01	0.01	0.01	1
Brachythecium rutabulum	0.01	0.01	0.01	1
Carex lurida	0.01	0.01	0.01	1
Carex swanii	0.01	0.01	0.01	1
Clethra acuminata	0.01	0.01	0.01	1
Cyperus strigosus	0.01	0.01	0.01	1
Danthonia compressa	0.01	0.01	0.01	1
Glyceria striata	0.01	0.01	0.01	1
Ipomoea	0.01	0.01	0.01	1
Juncus acuminatus	0.01	0.01	0.01	1
Juncus dudleyi	0.01	0.01	0.01	1
Juncus marginatus	0.01	0.01	0.01	1
Krigia biflora var. *biflora*	0.01	0.01	0.01	1
Lobelia inflata	0.01	0.01	0.01	1
Lyonia ligustrina var. *ligustrina*	0.01	0.01	0.01	1
Lysimachia ciliata	0.01	0.01	0.01	1
Mimulus alatus	0.01	0.01	0.01	1
Osmunda claytoniana	0.01	0.01	0.01	1
Oxalis stricta	0.01	0.01	0.01	1
Oxypolis rigidior	0.01	0.01	0.01	1
Polygonatum biflorum	0.01	0.01	0.01	1
Polygonum cuspidatum	0.01	0.01	0.01	1
Prunus	0.01	0.01	0.01	1
Rorippa palustris ssp. *palustris*	0.01	0.01	0.01	1
Rumex crispus ssp. *crispus*	0.01	0.01	0.01	1
Salix sericea	0.01	0.01	0.01	1
Solidago	0.01	0.01	0.01	1

Symphyotrichum	0.01	0.01	0.01	1
Symphyotrichum pilosum	0.01	0.01	0.01	1
Symphyotrichum racemosum	0.01	0.01	0.01	1
Thalictrum clavatum	0.01	0.01	0.01	1
Thalictrum revolutum	0.01	0.01	0.01	1
Tussilago farfara	0.01	0.01	0.01	1
Vaccinium stamineum	0.01	0.01	0.01	1
Verbesina alternifolia	0.01	0.01	0.01	1

Successional Pitch Pine Forest (CEGL006304) - 1 plot.

	% Cover			
Species	Mean	Min	Max	N
Tsuga canadensis	30.0	30	30	1
Pinus rigida	23.0	23	23	1
Acer rubrum	12.0	12	12	1
Betula lenta	10.0	10	10	1
Liriodendron tulipifera	6.0	6	6	1
Oxydendrum arboreum	6.0	6	6	1
Quercus coccinea var. *coccinea*	6.0	6	6	1
Quercus alba	4.0	4	4	1
Cornus florida	2.0	2	2	1
Magnolia acuminata	1.0	1	1	1
Carya alba	0.5	0.5	0.5	1
Fagus grandifolia	0.5	0.5	0.5	1
Hypnum imponens	0.5	0.5	0.5	1
Ilex opaca var. *opaca*	0.5	0.5	0.5	1
Leucobryum glaucum	0.5	0.5	0.5	1
Magnolia fraseri	0.5	0.5	0.5	1
Smilax glauca	0.5	0.5	0.5	1
Smilax rotundifolia	0.5	0.5	0.5	1
Vaccinium stamineum	0.5	0.5	0.5	1
Carex digitalis var. *digitalis*	0.01	0.01	0.01	1
Carex hirsutella	0.01	0.01	0.01	1
Chimaphila maculata	0.01	0.01	0.01	1
Cypripedium acaule	0.01	0.01	0.01	1
Euonymus americana	0.01	0.01	0.01	1
Goodyera pubescens	0.01	0.01	0.01	1
Maianthemum racemosum ssp. *racemosum*	0.01	0.01	0.01	1
Medeola virginiana	0.01	0.01	0.01	1
Mitchella repens	0.01	0.01	0.01	1
Monotropa uniflora	0.01	0.01	0.01	1
Polystichum acrostichoides	0.01	0.01	0.01	1
Prenanthes	0.01	0.01	0.01	1
Quercus velutina	0.01	0.01	0.01	1
Thuidium delicatulum	0.01	0.01	0.01	1
Vaccinium pallidum	0.01	0.01	0.01	1
Viburnum acerifolium	0.01	0.01	0.01	1
Viola hastata	0.01	0.01	0.01	1
Vitis	0.01	0.01	0.01	1

Successional Tuliptree Forest (CEGL007221) - 8 plots.

	% Cover			
Species	Mean	Min	Max	N
Liriodendron tulipifera	47.0	25	85	8
Acer rubrum	12.7	3	30	7
Thuidium delicatulum	3.3	0.01	10	7
Quercus rubra	1.8	0.01	10	7
Parthenocissus quinquefolia	1.0	0.5	3	6
Polystichum acrostichoides	1.0	0.5	2	6
Betula lenta	26.8	1	50	5
Tsuga canadensis	16.8	0.01	75	5
Acer saccharum var. *saccharum*	9.0	3	14	5
Ilex opaca var. *opaca*	8.7	0.5	35	5
Magnolia tripetala	6.4	0.5	25	5
Dryopteris intermedia	4.7	0.01	10	5
Tilia americana	1.2	0.01	3	5
Arisaema triphyllum ssp. *triphyllum*	0.1	0.01	0.5	5
Rhododendron maximum	26.0	2	89	4
Oxydendrum arboreum	3.4	0.5	10	4
Toxicodendron radicans	1.1	0.01	3	4
Packera aurea	0.8	0.01	1	4
Prunus serotina var. *serotina*	0.6	0.01	2	4
Fagus grandifolia	0.4	0.01	1	4
Hamamelis virginiana	0.3	0.01	1	4
Euonymus americana	0.1	0.01	0.5	4
Quercus alba	0.01	0.01	0.01	4
Lycopodium digitatum	30.2	0.5	50	3
Carpinus caroliniana ssp. *virginiana*	8.3	0.01	15	3
Hypnum imponens	2.5	0.5	4	3
Cornus florida	2.3	1	5	3
Carya cordiformis	1.0	0.01	3	3
Vitis aestivalis	0.8	0.5	1	3
Fraxinus americana	0.7	0.01	2	3
Amphicarpaea bracteata	0.5	0.01	1	3
Rosa multiflora	0.5	0.01	1	3
Smilax rotundifolia	0.5	0.01	1	3

Thelypteris noveboracensis	0.5	0.01	1	3
Eurybia divaricata	0.5	0.5	0.5	3
Quercus velutina	0.3	0.01	1	3
Amelanchier arborea var. *arborea*	0.3	0.01	0.5	3
Impatiens	0.3	0.01	0.5	3
Viola	0.3	0.01	0.5	3
Mitchella repens	0.2	0.01	0.5	3
Polypodium virginianum	0.2	0.01	0.5	3
Sanicula canadensis	0.01	0.01	0.01	3
Sassafras albidum	11.0	2	20	2
Lindera benzoin var. *pubescens*	5.5	1	10	2
Ilex montana	2.8	0.5	5	2
Ulmus rubra	2.5	0.01	5	2
Dicranum fulvum	2.0	1	3	2
Dennstaedtia punctilobula	1.8	0.5	3	2
Osmorhiza claytonii	1.8	0.5	3	2
Viola blanda var. *blanda*	1.8	0.5	3	2
Tiarella cordifolia	1.5	0.01	3	2
Leucobryum glaucum	1.0	1	1	2
Viola striata	0.8	0.5	1	2
Laportea canadensis	0.5	0.01	1	2
Maianthemum racemosum ssp. *racemosum*	0.5	0.01	1	2
Carex	0.5	0.5	0.5	2
Carex digitalis var. *digitalis*	0.5	0.5	0.5	2
Smilax glauca	0.5	0.5	0.5	2
Viola sororia	0.5	0.5	0.5	2
Carex swanii	0.3	0.01	0.5	2
Circaea lutetiana ssp. *canadensis*	0.3	0.01	0.5	2
Dryopteris marginalis	0.3	0.01	0.5	2
Galium triflorum	0.3	0.01	0.5	2
Polygonum virginianum	0.3	0.01	0.5	2
Rudbeckia laciniata var. *laciniata*	0.3	0.01	0.5	2
Smilax tamnoides	0.3	0.01	0.5	2
Vitis	0.3	0.01	0.5	2
Actaea racemosa var. *racemosa*	0.01	0.01	0.01	2
Ageratina altissima var. *altissima*	0.01	0.01	0.01	2
Agrimonia	0.01	0.01	0.01	2
Asplenium platyneuron	0.01	0.01	0.01	2
Goodyera pubescens	0.01	0.01	0.01	2
Pilea pumila var. *pumila*	0.01	0.01	0.01	2
Polygonatum pubescens	0.01	0.01	0.01	2
Quercus prinus	0.01	0.01	0.01	2
Rubus	0.01	0.01	0.01	2
Xanthorhiza simplicissima	0.01	0.01	0.01	2
Meehania cordata	40.0	40	40	1
Duchesnea indica	30.0	30	30	1
Liquidambar styraciflua	20.0	20	20	1
Clethra acuminata	10.0	10	10	1
Populus grandidentata	10.0	10	10	1
Betula alleghaniensis var. *alleghaniensis*	5.0	5	5	1
Anemone quinquefolia var. *quinquefolia*	3.0	3	3	1
Umbilicaria	3.0	3	3	1
Bryoandersonia illecebra	2.0	2	2	1
Dicranum scoparium	2.0	2	2	1
Loeskeobryum brevirostre	2.0	2	2	1
Polygonatum biflorum	2.0	2	2	1
Acer negundo var. *negundo*	1.0	1	1	1
Asimina triloba	1.0	1	1	1
Carex plantaginea	1.0	1	1	1
Geum virginianum	1.0	1	1	1
Ostrya virginiana var. *virginiana*	1.0	1	1	1
Phegopteris hexagonoptera	1.0	1	1	1
Pinus virginiana	1.0	1	1	1
Plagiomnium ciliare	1.0	1	1	1
Podophyllum peltatum	1.0	1	1	1
Potentilla canadensis var. *canadensis*	1.0	1	1	1
Acer nigrum	0.5	0.5	0.5	1
Aesculus flava	0.5	0.5	0.5	1
Anemone lancifolia	0.5	0.5	0.5	1
Carex amphibola	0.5	0.5	0.5	1
Delphinium tricorne	0.5	0.5	0.5	1
Deparia acrostichoides	0.5	0.5	0.5	1
Desmodium rotundifolium	0.5	0.5	0.5	1
Dichanthelium boscii	0.5	0.5	0.5	1
Dicranum	0.5	0.5	0.5	1
Diplazium pycnocarpon	0.5	0.5	0.5	1
Festuca subverticillata	0.5	0.5	0.5	1
Heuchera villosa var. *villosa*	0.5	0.5	0.5	1
Hexastylis virginica	0.5	0.5	0.5	1
Kalmia latifolia	0.5	0.5	0.5	1

Lophocolea heterophylla	0.5	0.5	0.5	1
Luzula multiflora ssp. *multiflora* var. *multiflora*	0.5	0.5	0.5	1
Magnolia acuminata	0.5	0.5	0.5	1
Magnolia fraseri	0.5	0.5	0.5	1
Nyssa sylvatica	0.5	0.5	0.5	1
Polytrichum	0.5	0.5	0.5	1
Rubus allegheniensis	0.5	0.5	0.5	1
Solidago flexicaulis	0.5	0.5	0.5	1
Stellaria pubera	0.5	0.5	0.5	1
Symphyotrichum puniceum var. *puniceum*	0.5	0.5	0.5	1
Trillium erectum	0.5	0.5	0.5	1
Viola canadensis	0.5	0.5	0.5	1
Viola sagittata	0.5	0.5	0.5	1
Asarum canadense	0.01	0.01	0.01	1
Bazzania trilobata	0.01	0.01	0.01	1
Botrychium virginianum	0.01	0.01	0.01	1
Brachyelytrum erectum	0.01	0.01	0.01	1
Campsis radicans	0.01	0.01	0.01	1
Cardamine concatenata	0.01	0.01	0.01	1
Cardamine diphylla	0.01	0.01	0.01	1
Carex blanda	0.01	0.01	0.01	1
Carex gracillima	0.01	0.01	0.01	1
Carex jamesii	0.01	0.01	0.01	1
Carex gracilescens	0.01	0.01	0.01	1
Carya alba	0.01	0.01	0.01	1
Cercis canadensis var. *canadensis*	0.01	0.01	0.01	1
Cinna arundinacea	0.01	0.01	0.01	1
Cladonia	0.01	0.01	0.01	1
Corylus americana	0.01	0.01	0.01	1
Cryptotaenia canadensis	0.01	0.01	0.01	1
Cymophyllus fraserianus	0.01	0.01	0.01	1
Desmodium paniculatum var. *paniculatum*	0.01	0.01	0.01	1
Dicentra canadensis	0.01	0.01	0.01	1
Dichanthelium clandestinum	0.01	0.01	0.01	1
Dichanthelium dichotomum ssp. *dichotomum*	0.01	0.01	0.01	1
Dioscorea	0.01	0.01	0.01	1
Eurhynchium hians	0.01	0.01	0.01	1
Fissidens dubius	0.01	0.01	0.01	1
Galium circaezans var. *hypomalacum*	0.01	0.01	0.01	1
Geum	0.01	0.01	0.01	1
Glechoma hederacea	0.01	0.01	0.01	1
Hydrangea arborescens	0.01	0.01	0.01	1
Hydrophyllum canadense	0.01	0.01	0.01	1
Juniperus virginiana var. *virginiana*	0.01	0.01	0.01	1
Leucobryum albidum	0.01	0.01	0.01	1
Lobelia inflata	0.01	0.01	0.01	1
Lonicera japonica	0.01	0.01	0.01	1
Monotropa uniflora	0.01	0.01	0.01	1
Nowellia curvifolia	0.01	0.01	0.01	1
Phryma leptostachya	0.01	0.01	0.01	1
Potentilla simplex	0.01	0.01	0.01	1
Pyrularia pubera	0.01	0.01	0.01	1
Ranunculus recurvatus var. *recurvatus*	0.01	0.01	0.01	1
Rubus odoratus var. *odoratus*	0.01	0.01	0.01	1
Salvia lyrata	0.01	0.01	0.01	1
Sambucus nigra ssp. *canadensis*	0.01	0.01	0.01	1
Sanguinaria canadensis	0.01	0.01	0.01	1
Smilax ecirrata	0.01	0.01	0.01	1
Solidago	0.01	0.01	0.01	1
Solidago caesia	0.01	0.01	0.01	1
Stylophorum diphyllum	0.01	0.01	0.01	1
Symphyotrichum	0.01	0.01	0.01	1
Viburnum acerifolium	0.01	0.01	0.01	1

Successional Virginia Pine Forest (CEGL002591) - 3 plots.

	% Cover			
Species	Mean	Min	Max	N
Pinus virginiana	53.3	30	95	3
Acer rubrum	2.2	0.5	5	3
Fagus grandifolia	1.0	0.01	3	3
Ilex opaca var. *opaca*	0.5	0.01	1	3
Smilax glauca	0.01	0.01	0.01	3
Tsuga canadensis	75.0	70	80	2
Liriodendron tulipifera	6.5	3	10	2
Oxydendrum arboreum	4.0	3	5	2
Quercus alba	3.5	0.01	7	2
Betula lenta	2.0	1	3	2
Quercus rubra	1.5	0.01	3	2
Lycopodium digitatum	0.8	0.5	1	2
Leucobryum glaucum	0.5	0.01	1	2
Sassafras albidum	0.3	0.01	0.5	2
Nyssa sylvatica	0.01	0.01	0.01	2

Smilax rotundifolia	0.01	0.01	0.01	2
Dicranum scoparium	40.0	40	40	1
Polytrichum commune	30.0	30	30	1
Prunus serotina var. *serotina*	5.0	5	5	1
Cladonia subtenuis	1.0	1	1	1
Cornus florida	1.0	1	1	1
Platismatia tuckermanii	1.0	1	1	1
Sphagnum capillifolium var. *capillifolium*	1.0	1	1	1
Tuckermannopsis ciliaris	1.0	1	1	1
Cladonia cristatella	0.5	0.5	0.5	1
Cladonia fimbriata	0.5	0.5	0.5	1
Acer saccharum var. *saccharum*	0.01	0.01	0.01	1
Achillea millefolium var. *occidentalis*	0.01	0.01	0.01	1
Amelanchier	0.01	0.01	0.01	1
Botrychium virginianum	0.01	0.01	0.01	1
Chimaphila maculata	0.01	0.01	0.01	1
Cirsium	0.01	0.01	0.01	1
Crataegus	0.01	0.01	0.01	1
Cypripedium acaule	0.01	0.01	0.01	1
Danthonia spicata	0.01	0.01	0.01	1
Dichanthelium laxiflorum	0.01	0.01	0.01	1
Dichanthelium polyanthes	0.01	0.01	0.01	1
Euonymus americana	0.01	0.01	0.01	1
Fraxinus americana	0.01	0.01	0.01	1
Gaylussacia baccata	0.01	0.01	0.01	1
Goodyera pubescens	0.01	0.01	0.01	1
Hamamelis virginiana	0.01	0.01	0.01	1
Hieracium caespitosum	0.01	0.01	0.01	1
Hypnum imponens	0.01	0.01	0.01	1
Lespedeza cuneata	0.01	0.01	0.01	1
Mitchella repens	0.01	0.01	0.01	1
Parthenocissus quinquefolia	0.01	0.01	0.01	1
Polystichum acrostichoides	0.01	0.01	0.01	1
Potentilla canadensis var. *canadensis*	0.01	0.01	0.01	1
Prunus pensylvanica var. *pensylvanica*	0.01	0.01	0.01	1
Rosa multiflora	0.01	0.01	0.01	1
Rubus	0.01	0.01	0.01	1
Rubus flagellaris	0.01	0.01	0.01	1
Schizachyrium scoparium var. *scoparium*	0.01	0.01	0.01	1
Solidago rugosa	0.01	0.01	0.01	1
Taraxacum officinale ssp. *officinale*	0.01	0.01	0.01	1
Vaccinium pallidum	0.01	0.01	0.01	1
Veronica chamaedrys	0.01	0.01	0.01	1
Viola cucullata	0.01	0.01	0.01	1

Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222) - 17 plots.

	% Cover			
Species	Mean	Min	Max	N
Acer saccharum var. *saccharum*	22.1	2	65	17
Polystichum acrostichoides	4.6	0.5	25	17
Quercus rubra	4.3	0.01	15	15
Liriodendron tulipifera	14.1	2	33	14
Laportea canadensis	11.7	0.01	35	14
Thuidium delicatulum	10.0	0.5	40	14
Arisaema triphyllum ssp. *triphyllum*	0.2	0.01	0.5	14
Dryopteris intermedia	10.9	0.01	55	13
Dryopteris marginalis	4.7	0.01	40	13
Acer rubrum	4.0	0.01	12	13
Tilia americana	25.1	0.5	50	12
Fraxinus americana	2.9	0.01	20	12
Parthenocissus quinquefolia	1.2	0.01	8	12
Tiarella cordifolia	2.1	0.01	10	11
Viola canadensis	0.8	0.01	5	11
Smilax rotundifolia	0.7	0.01	3	11
Eurybia divaricata	0.2	0.01	1	11
Fagus grandifolia	13.6	2	60	10
Hamamelis virginiana	1.7	0.5	5	10
Galium triflorum	0.5	0.01	1	10
Magnolia acuminata	6.3	0.5	20	9
Betula lenta	4.3	0.01	10	9
Asarum canadense	4.1	0.01	15	9
Osmorhiza claytonii	0.5	0.01	1	9
Maianthemum racemosum ssp. *racemosum*	0.5	0.01	3	9
Euonymus americana	0.1	0.01	0.5	9
Tsuga canadensis	6.8	0.5	20	8
Carya cordiformis	3.1	0.01	23	8
Actaea racemosa var. *racemosa*	1.2	0.01	5	8
Vitis aestivalis	1.0	0.01	2	8
Geranium maculatum	0.8	0.01	3	8
Ageratina altissima var. *altissima*	0.2	0.01	0.5	8

Botrychium virginianum	0.1	0.01	0.5	8
Lindera benzoin	3.3	0.01	15	7
Ulmus rubra	2.9	0.01	10	7
Toxicodendron radicans	0.6	0.01	2	7
Smilax tamnoides	0.4	0.01	1	7
Circaea lutetiana ssp. *canadensis*	0.4	0.01	1	7
Rosa multiflora	0.4	0.01	0.5	7
Prosartes lanuginosa	0.1	0.01	0.5	7
Sedum ternatum	2.1	0.01	10	6
Carex digitalis var. *digitalis*	0.4	0.01	2	6
Sanguinaria canadensis	0.3	0.01	1	6
Panax quinquefolius	0.2	0.01	0.5	6
Magnolia fraseri	4.0	1	8	5
Brachythecium laetum	2.7	0.01	5	5
Diplazium pycnocarpon	1.2	0.01	5	5
Impatiens	1.0	0.5	2	5
Pilea pumila var. *pumila*	0.8	0.01	3	5
Phegopteris hexagonoptera	0.7	0.01	3	5
Acer pensylvanicum	0.7	0.01	1	5
Stellaria pubera	0.6	0.01	1	5
Adiantum pedatum	0.5	0.01	2	5
Sambucus nigra ssp. *canadensis*	0.5	0.01	1	5
Brachyelytrum erectum	0.3	0.01	1	5
Solidago flexicaulis	0.3	0.01	1	5
Viburnum acerifolium	0.3	0.01	0.5	5
Collinsonia canadensis	0.2	0.01	0.5	5
Aristolochia macrophylla	0.1	0.01	0.5	5
Trillium erectum	0.1	0.01	0.5	5
Polygonatum pubescens	0.01	0.01	0.01	5
Aesculus flava	13.0	0.01	30	4
Asimina triloba	9.3	0.01	25	4
Cercis canadensis var. *canadensis*	6.8	0.5	25	4
Rhododendron maximum	2.6	0.5	6	4
Amphicarpaea bracteata	2.0	0.01	5	4
Viola hastata	1.5	0.01	5	4
Festuca subverticillata	1.5	0.5	3	4
Lindera benzoin var. *pubescens*	1.5	0.5	4	4
Anomodon attenuatus	1.4	0.01	3	4
Lindera benzoin var. *benzoin*	1.3	0.5	3	4
Carya alba	1.0	0.01	3	4
Galium circaezans var. *hypomalacum*	0.5	0.01	1	4
Viola sagittata	0.5	0.01	1	4
Vitis	0.5	0.01	1	4
Dioscorea quaternata	0.4	0.01	1	4
Hydrangea arborescens	0.4	0.01	1	4
Viola sororia	0.3	0.01	0.5	4
Carex albursina	0.1	0.01	0.5	4
Caulophyllum thalictroides	0.1	0.01	0.5	4
Ranunculus recurvatus var. *recurvatus*	0.1	0.01	0.5	4
Tilia americana var. *americana*	33.3	30	40	3
Verbesina alternifolia	3.7	0.01	10	3
Loeskeobryum brevirostre	3.7	1	5	3
Thelypteris noveboracensis	3.7	0.5	10	3
Ostrya virginiana var. *virginiana*	2.2	0.5	5	3
Quercus prinus	2.2	0.5	5	3
Dicranum fulvum	2.0	0.01	5	3
Viola	1.5	0.5	3	3
Quercus alba	1.2	0.01	3	3
Magnolia tripetala	1.0	0.5	2	3
Carex platyphylla	0.8	0.5	1	3
Carex laxiflora	0.7	0.01	1	3
Prunus serotina var. *serotina*	0.7	0.01	1	3
Galium aparine	0.7	0.5	1	3
Sambucus racemosa var. *racemosa*	0.5	0.5	0.5	3
Hydrophyllum canadense	0.3	0.01	1	3
Viola striata	0.3	0.01	1	3
Deparia acrostichoides	0.3	0.01	0.5	3
Mitchella repens	0.3	0.01	0.5	3
Rubus	0.3	0.01	0.5	3
Asplenium rhizophyllum	0.2	0.01	0.5	3
Cornus alternifolia	0.2	0.01	0.5	3
Medeola virginiana	0.2	0.01	0.5	3
Prenanthes	0.2	0.01	0.5	3
Solidago caesia	0.2	0.01	0.5	3
Carex radiata	0.01	0.01	0.01	3
Scutellaria elliptica var. *hirsuta*	0.01	0.01	0.01	3
Hypnum imponens	15.0	0.01	30	2
Juglans cinerea	3.5	2	5	2

Aulacomnium heterostichum	3.0	1	5	2
Diarrhena americana	3.0	1	5	2
Viola blanda var. *blanda*	2.5	0.01	5	2
Plagiomnium ciliare	1.5	1	2	2
Plagiomnium cuspidatum	1.5	1	2	2
Climacium americanum	1.0	1	1	2
Rhodobryum ontariense	1.0	1	1	2
Duchesnea indica	0.8	0.5	1	2
Ilex opaca var. *opaca*	0.5	0.01	1	2
Polypodium virginianum	0.5	0.01	1	2
Sassafras albidum	0.5	0.01	1	2
Cornus florida	0.5	0.5	0.5	2
Leucobryum glaucum	0.5	0.5	0.5	2
Podophyllum peltatum	0.5	0.5	0.5	2
Ranunculus abortivus	0.5	0.5	0.5	2
Rubus phoenicolasius	0.5	0.5	0.5	2
Smilax glauca	0.5	0.5	0.5	2
Arabis laevigata var. *laevigata*	0.3	0.01	0.5	2
Cardamine concatenata	0.3	0.01	0.5	2
Carex cumberlandensis	0.3	0.01	0.5	2
Dichanthelium boscii	0.3	0.01	0.5	2
Geum virginianum	0.3	0.01	0.5	2
Microstegium vimineum	0.3	0.01	0.5	2
Phryma leptostachya	0.3	0.01	0.5	2
Poa sylvestris	0.3	0.01	0.5	2
Polygonum virginianum	0.3	0.01	0.5	2
Acer spicatum	0.01	0.01	0.01	2
Aplectrum hyemale	0.01	0.01	0.01	2
Asplenium platyneuron	0.01	0.01	0.01	2
Clematis virginiana	0.01	0.01	0.01	2
Conopholis americana	0.01	0.01	0.01	2
Epifagus virginiana	0.01	0.01	0.01	2
Hexastylis virginica	0.01	0.01	0.01	2
Menispermum canadense	0.01	0.01	0.01	2
Mnium	0.01	0.01	0.01	2
Monarda	0.01	0.01	0.01	2
Sanicula trifoliata	0.01	0.01	0.01	2
Thalictrum	0.01	0.01	0.01	2
Viola ×palmata	0.01	0.01	0.01	2
Tilia americana var. *heterophylla*	40.0	40	40	1
Carpinus caroliniana ssp. *virginiana*	10.0	10	10	1
Prunus pensylvanica var. *pensylvanica*	10.0	10	10	1
Quercus muehlenbergii	10.0	10	10	1
Staphylea trifolia	6.0	6	6	1
Carya ovata	5.0	5	5	1
Flavoparmelia baltimorensis	5.0	5	5	1
Betula alleghaniensis var. *alleghaniensis*	2.0	2	2	1
Carex amphibola	2.0	2	2	1
Acer nigrum	1.0	1	1	1
Atrichum undulatum	1.0	1	1	1
Brachythecium rutabulum	1.0	1	1	1
Hydrastis canadensis	1.0	1	1	1
Platanus occidentalis	1.0	1	1	1
Polygonum caespitosum var. *longisetum*	1.0	1	1	1
Robinia pseudoacacia	1.0	1	1	1
Rubus occidentalis	1.0	1	1	1
Steerecleus serrulatus	1.0	1	1	1
Stellaria media ssp. *pallida*	1.0	1	1	1
Stylophorum diphyllum	1.0	1	1	1
Trichocolea tomentella	1.0	1	1	1
Verbesina occidentalis	1.0	1	1	1
Brachythecium salebrosum	0.5	0.5	0.5	1
Campanulastrum americanum	0.5	0.5	0.5	1
Cardamine parviflora var. *arenicola*	0.5	0.5	0.5	1
Carex blanda	0.5	0.5	0.5	1
Elymus hystrix var. *hystrix*	0.5	0.5	0.5	1
Erigeron philadelphicus var. *philadelphicus*	0.5	0.5	0.5	1
Geum canadense var. *canadense*	0.5	0.5	0.5	1
Hypnum	0.5	0.5	0.5	1
Mitella diphylla	0.5	0.5	0.5	1
Morus rubra var. *rubra*	0.5	0.5	0.5	1
Oxalis grandis	0.5	0.5	0.5	1
Polymnia canadensis	0.5	0.5	0.5	1
Rhododendron calendulaceum	0.5	0.5	0.5	1
Ribes	0.5	0.5	0.5	1
Rubus flagellaris	0.5	0.5	0.5	1
Sanicula	0.5	0.5	0.5	1
Sanicula canadensis	0.5	0.5	0.5	1

Smilax herbacea	0.5	0.5	0.5	1
Solidago	0.5	0.5	0.5	1
Ailanthus altissima	0.01	0.01	0.01	1
Athyrium filix-femina var. *angustum*	0.01	0.01	0.01	1
Brotherella recurvans	0.01	0.01	0.01	1
Cardamine diphylla	0.01	0.01	0.01	1
Cardamine hirsuta	0.01	0.01	0.01	1
Carex	0.01	0.01	0.01	1
Carex aestivalis	0.01	0.01	0.01	1
Carex debilis var. *rudgei*	0.01	0.01	0.01	1
Carex plantaginea	0.01	0.01	0.01	1
Carex rosea	0.01	0.01	0.01	1
Carex swanii	0.01	0.01	0.01	1
Cryptotaenia canadensis	0.01	0.01	0.01	1
Delphinium tricorne	0.01	0.01	0.01	1
Desmodium glutinosum	0.01	0.01	0.01	1
Desmodium nudiflorum	0.01	0.01	0.01	1
Dicentra	0.01	0.01	0.01	1
Dicentra canadensis	0.01	0.01	0.01	1
Dicranum	0.01	0.01	0.01	1
Dryopteris goldiana	0.01	0.01	0.01	1
Eupatorium purpureum var. *purpureum*	0.01	0.01	0.01	1
Galium circaezans	0.01	0.01	0.01	1
Galium circaezans var. *circaezans*	0.01	0.01	0.01	1
Galium lanceolatum	0.01	0.01	0.01	1
Hepatica nobilis var. *acuta*	0.01	0.01	0.01	1
Hybanthus concolor	0.01	0.01	0.01	1
Impatiens pallida	0.01	0.01	0.01	1
Lamium purpureum var. *purpureum*	0.01	0.01	0.01	1
Lilium canadense	0.01	0.01	0.01	1
Monotropa uniflora	0.01	0.01	0.01	1
Muhlenbergia	0.01	0.01	0.01	1
Osmunda claytoniana	0.01	0.01	0.01	1
Packera aurea	0.01	0.01	0.01	1
Packera obovata	0.01	0.01	0.01	1
Phytolacca americana var. *americana*	0.01	0.01	0.01	1
Platanthera	0.01	0.01	0.01	1
Poa alsodes	0.01	0.01	0.01	1
Polygonatum biflorum	0.01	0.01	0.01	1
Ranunculus allegheniensis	0.01	0.01	0.01	1
Ribes cynosbati	0.01	0.01	0.01	1
Sanicula canadensis var. *grandis*	0.01	0.01	0.01	1
Solidago curtisii	0.01	0.01	0.01	1
Streptopus lanceolatus var. *roseus*	0.01	0.01	0.01	1
Thalictrum thalictroides	0.01	0.01	0.01	1
Trillium	0.01	0.01	0.01	1
Xylaria hypoxylon	0.01	0.01	0.01	1

(Virginia, Pitch) Pine Floodplain Forest (CEGL006624) - 6 plots.

	% Cover			
Species	Mean	Min	Max	N
Nyssa sylvatica	9.9	0.5	45	6
Tsuga canadensis	3.5	0.01	10	6
Ilex opaca var. *opaca*	3.5	1	6	6
Pinus virginiana	28.2	0.01	45	5
Acer rubrum	10.0	0.5	30	5
Betula nigra	5.4	1	10	5
Liriodendron tulipifera	2.8	0.01	5	5
Quercus alba	1.9	0.01	8	5
Kalmia latifolia	6.6	0.5	12	4
Fagus grandifolia	4.3	1	10	4
Hamamelis virginiana	3.1	0.5	5	4
Carpinus caroliniana ssp. *virginiana*	2.5	0.5	6	4
Toxicodendron radicans	1.0	0.01	3	4
Fraxinus pennsylvanica	1.0	0.5	2	4
Xanthorhiza simplicissima	1.0	0.5	2	4
Physocarpus opulifolius var. *opulifolius*	0.8	0.5	1	4
Euonymus americana	0.6	0.5	1	4
Lysimachia quadrifolia	0.6	0.5	1	4
Potentilla canadensis var. *canadensis*	0.6	0.5	1	4
Rudbeckia laciniata var. *laciniata*	0.6	0.5	1	4
Oxydendrum arboreum	10.2	0.5	23	3
Acer saccharum var. *saccharum*	3.7	0.5	10	3
Juniperus virginiana var. *virginiana*	3.5	0.5	5	3
Viburnum nudum var. *cassinoides*	3.0	0.01	5	3
Chionanthus virginicus	2.8	0.5	7	3
Rhododendron maximum	2.0	0.5	5	3

Vaccinium corymbosum	1.7	1	2	3
Packera paupercula	1.2	0.5	2	3
Ipomoea pandurata	1.0	0.5	2	3
Viburnum acerifolium	1.0	0.5	2	3
Viola pedata	0.8	0.01	2	3
Vaccinium pallidum	0.8	0.5	1	3
Prunus serotina var. *serotina*	0.7	0.01	1	3
Deschampsia flexuosa var. *flexuosa*	0.7	0.5	1	3
Elaeagnus umbellata var. *parvifolia*	0.7	0.5	1	3
Pedicularis canadensis ssp. *canadensis*	0.7	0.5	1	3
Solidago simplex ssp. *randii* var. *racemosa*	0.7	0.5	1	3
Vaccinium stamineum	0.7	0.5	1	3
Mitchella repens	0.5	0.01	1	3
Eurybia divaricata	0.5	0.5	0.5	3
Ilex verticillata	0.5	0.5	0.5	3
Euphorbia corollata	0.3	0.01	0.5	3
Packera aurea	0.3	0.01	0.5	3
Quercus rubra	0.2	0.01	0.5	3
Vitis	0.01	0.01	0.01	3
Pinus rigida	37.5	35	40	2
Quercus prinus	10.0	5	15	2
Liquidambar styraciflua	3.0	1	5	2
Rosa multiflora	2.8	0.5	5	2
Rhododendron arborescens	2.0	1	3	2
Sorghastrum nutans	2.0	1	3	2
Carya alba	1.5	0.01	3	2
Andropogon gerardii	1.3	0.5	2	2
Dicranum scoparium	1.3	0.5	2	2
Hypoxis hirsuta	1.3	0.5	2	2
Magnolia tripetala	1.3	0.5	2	2
Quercus velutina	1.0	0.01	2	2
Hypericum prolificum	1.0	1	1	2
Rubus	1.0	1	1	2
Betula lenta	0.8	0.5	1	2
Cornus amomum	0.8	0.5	1	2
Lonicera japonica	0.8	0.5	1	2
Lyonia ligustrina var. *ligustrina*	0.8	0.5	1	2
Panicum virgatum	0.8	0.5	1	2
Polystichum acrostichoides	0.8	0.5	1	2
Acer pensylvanicum	0.5	0.5	0.5	2
Coreopsis tripteris	0.5	0.5	0.5	2
Erigeron pulchellus	0.5	0.5	0.5	2
Eupatorium fistulosum	0.5	0.5	0.5	2
Gaylussacia baccata	0.5	0.5	0.5	2

Goodyera pubescens	0.5	0.5	0.5	2
Iris	0.5	0.5	0.5	2
Iris cristata	0.5	0.5	0.5	2
Liatris scariosa var. *scariosa*	0.5	0.5	0.5	2
Maianthemum racemosum ssp. *racemosum*	0.5	0.5	0.5	2
Osmunda regalis var. *spectabilis*	0.5	0.5	0.5	2
Quercus	0.5	0.5	0.5	2
Smilax glauca	0.5	0.5	0.5	2
Symphyotrichum lateriflorum	0.5	0.5	0.5	2
Thalictrum	0.5	0.5	0.5	2
Baptisia tinctoria	0.3	0.01	0.5	2
Clematis virginiana	0.3	0.01	0.5	2
Cypripedium acaule	0.3	0.01	0.5	2
Dichanthelium laxiflorum	0.3	0.01	0.5	2
Parthenocissus quinquefolia	0.3	0.01	0.5	2
Zizia aptera	0.3	0.01	0.5	2
Cornus florida	8.0	8	8	1
Schizachyrium scoparium var. *scoparium*	8.0	8	8	1
Robinia pseudoacacia	6.0	6	6	1
Diospyros virginiana	5.0	5	5	1
Alnus serrulata	3.0	3	3	1
Hypnum imponens	3.0	3	3	1
Platanus occidentalis	3.0	3	3	1
Poa alsodes	3.0	3	3	1
Carya cordiformis	2.0	2	2	1
Leucobryum albidum	2.0	2	2	1
Lindera benzoin	2.0	2	2	1
Tephrosia virginiana	2.0	2	2	1
Anemone quinquefolia var. *quinquefolia*	1.0	1	1	1
Anthoxanthum odoratum ssp. *odoratum*	1.0	1	1	1
Brachyelytrum erectum	1.0	1	1	1
Dichanthelium clandestinum	1.0	1	1	1
Gaultheria procumbens	1.0	1	1	1
Grimmia pilifera	1.0	1	1	1
Houstonia serpyllifolia	1.0	1	1	1
Leucanthemum vulgare	1.0	1	1	1
Luzula echinata	1.0	1	1	1
Rhododendron periclymenoides	1.0	1	1	1
Salvia lyrata	1.0	1	1	1

Symphyotrichum patens var. *patens*	1.0	1	1	1
Thalictrum thalictroides	1.0	1	1	1
Thelypteris noveboracensis	1.0	1	1	1
Viola cucullata	1.0	1	1	1
Ageratina altissima var. *altissima*	0.5	0.5	0.5	1
Agrostis perennans	0.5	0.5	0.5	1
Amphicarpaea bracteata	0.5	0.5	0.5	1
Arisaema triphyllum ssp. *triphyllum*	0.5	0.5	0.5	1
Asimina triloba	0.5	0.5	0.5	1
Bidens frondosa	0.5	0.5	0.5	1
Bryoandersonia illecebra	0.5	0.5	0.5	1
Carex caroliniana	0.5	0.5	0.5	1
Chimaphila maculata	0.5	0.5	0.5	1
Chrysopsis mariana	0.5	0.5	0.5	1
Cladonia	0.5	0.5	0.5	1
Dichanthelium dichotomum	0.5	0.5	0.5	1
Dichanthelium dichotomum ssp. *dichotomum*	0.5	0.5	0.5	1
Erigeron	0.5	0.5	0.5	1
Erigeron pulchellus var. *brauniae*	0.5	0.5	0.5	1
Fraxinus	0.5	0.5	0.5	1
Fraxinus americana	0.5	0.5	0.5	1
Houstonia caerulea	0.5	0.5	0.5	1
Hypericum hypericoides ssp. *multicaule*	0.5	0.5	0.5	1
Hypericum mutilum	0.5	0.5	0.5	1
Hypnum	0.5	0.5	0.5	1
Ionactis linariifolius	0.5	0.5	0.5	1
Lasallia papulosa	0.5	0.5	0.5	1
Lespedeza cuneata	0.5	0.5	0.5	1
Leucobryum glaucum	0.5	0.5	0.5	1
Linum virginianum	0.5	0.5	0.5	1
Lonicera morrowii	0.5	0.5	0.5	1
Parmotrema hypotropum	0.5	0.5	0.5	1
Polygonatum biflorum	0.5	0.5	0.5	1
Polytrichum	0.5	0.5	0.5	1
Prenanthes alba	0.5	0.5	0.5	1
Rubus flagellaris	0.5	0.5	0.5	1
Rubus phoenicolasius	0.5	0.5	0.5	1
Sericocarpus asteroides	0.5	0.5	0.5	1
Smilax herbacea	0.5	0.5	0.5	1
Smilax rotundifolia	0.5	0.5	0.5	1
Solidago	0.5	0.5	0.5	1
Solidago bicolor	0.5	0.5	0.5	1
Solidago curtisii	0.5	0.5	0.5	1
Symphyotrichum laeve	0.5	0.5	0.5	1
Trautvetteria caroliniensis var. *caroliniensis*	0.5	0.5	0.5	1
Trifolium pratense	0.5	0.5	0.5	1
Uvularia puberula	0.5	0.5	0.5	1
Viola	0.5	0.5	0.5	1
Viola sororia	0.5	0.5	0.5	1
Viola striata	0.5	0.5	0.5	1
Zizia trifoliata	0.5	0.5	0.5	1
Achillea millefolium var. *occidentalis*	0.01	0.01	0.01	1
Amelanchier stolonifera	0.01	0.01	0.01	1
Carex	0.01	0.01	0.01	1
Carex digitalis var. *digitalis*	0.01	0.01	0.01	1
Chelone glabra	0.01	0.01	0.01	1
Collinsonia canadensis	0.01	0.01	0.01	1
Coreopsis major	0.01	0.01	0.01	1
Crataegus	0.01	0.01	0.01	1
Dichanthelium polyanthes	0.01	0.01	0.01	1
Dryopteris marginalis	0.01	0.01	0.01	1
Eupatorium rotundifolium var. *ovatum*	0.01	0.01	0.01	1
Galax urceolata	0.01	0.01	0.01	1
Glechoma hederacea	0.01	0.01	0.01	1
Hexastylis virginica	0.01	0.01	0.01	1
Lobelia inflata	0.01	0.01	0.01	1
Magnolia acuminata	0.01	0.01	0.01	1
Oxalis dillenii	0.01	0.01	0.01	1
Phlox	0.01	0.01	0.01	1
Porteranthus trifoliatus	0.01	0.01	0.01	1
Scutellaria elliptica var. *hirsuta*	0.01	0.01	0.01	1
Symphyotrichum	0.01	0.01	0.01	1
Symphyotrichum boreale	0.01	0.01	0.01	1
Symphyotrichum cordifolium	0.01	0.01	0.01	1
Thalictrum clavatum	0.01	0.01	0.01	1
Thuidium delicatulum	0.01	0.01	0.01	1
Viola ×primulifolia	0.01	0.01	0.01	1
Xanthoparmelia plittii	0.01	0.01	0.01	1
Zizia	0.01	0.01	0.01	1

Yellow Birch Cold Cove Forest (CEGL007861) - 3 plots.

Species	% Cover Mean	Min	Max	N
Betula alleghaniensis var. *alleghaniensis*	44.3	23	60	3
Tsuga canadensis	13.3	10	15	3
Betula lenta	9.7	3	15	3
Acer rubrum	5.0	3	7	3
Hamamelis virginiana	1.2	0.01	3	3
Dryopteris intermedia	1.2	0.5	2	3
Smilax rotundifolia	0.7	0.5	1	3
Eurybia divaricata	0.5	0.01	1	3
Rhododendron maximum	35.0	10	60	2
Liriodendron tulipifera	25.0	10	40	2
Polystichum acrostichoides	5.3	0.5	10	2
Thuidium delicatulum	3.5	2	5	2
Clethra acuminata	3.0	1	5	2
Hypnum imponens	3.0	1	5	2
Fraxinus americana	2.0	1	3	2
Vitis	1.0	1	1	2
Polypodium virginianum	0.3	0.01	0.5	2
Anemone quinquefolia var. *quinquefolia*	0.01	0.01	0.01	2
Ilex opaca var. *opaca*	10.0	10	10	1
Magnolia fraseri	10.0	10	10	1
Acer saccharum var. *saccharum*	5.0	5	5	1
Tiarella cordifolia	5.0	5	5	1
Amelanchier arborea var. *arborea*	3.0	3	3	1
Nyssa sylvatica	3.0	3	3	1
Bryoandersonia illecebra	1.0	1	1	1
Carpinus caroliniana ssp. *virginiana*	1.0	1	1	1
Mnium hornum	1.0	1	1	1
Parthenocissus quinquefolia	1.0	1	1	1
Asarum canadense	0.5	0.5	0.5	1
Athyrium filix-femina ssp. *asplenioides*	0.5	0.5	0.5	1
Bazzania trilobata	0.5	0.5	0.5	1
Brachyelytrum septentrionale	0.5	0.5	0.5	1
Cymophyllus fraserianus	0.5	0.5	0.5	1
Geranium maculatum	0.5	0.5	0.5	1
Hepatica nobilis var. *acuta*	0.5	0.5	0.5	1
Hypnum	0.5	0.5	0.5	1
Ilex montana	0.5	0.5	0.5	1
Laportea canadensis	0.5	0.5	0.5	1
Leucobryum glaucum	0.5	0.5	0.5	1
Polytrichum	0.5	0.5	0.5	1
Sambucus racemosa var. *racemosa*	0.5	0.5	0.5	1
Viola blanda var. *blanda*	0.5	0.5	0.5	1
Arisaema triphyllum ssp. *triphyllum*	0.01	0.01	0.01	1
Aulacomnium heterostichum	0.01	0.01	0.01	1
Carex laxiflora	0.01	0.01	0.01	1
Carya cordiformis	0.01	0.01	0.01	1
Chimaphila maculata	0.01	0.01	0.01	1
Dichanthelium dichotomum	0.01	0.01	0.01	1
Fagus grandifolia	0.01	0.01	0.01	1
Medeola virginiana	0.01	0.01	0.01	1
Monotropa uniflora	0.01	0.01	0.01	1
Quercus rubra	0.01	0.01	0.01	1
Solidago simplex ssp. *randii* var. *racemosa*	0.01	0.01	0.01	1
Symphyotrichum lateriflorum	0.01	0.01	0.01	1
Thalictrum	0.01	0.01	0.01	1

Appendix I. Key to the vegetation associations and map classes of Gauley River National Recreation Area.

The following dichotomous key is designed for field identification of natural and semi-natural vegetation within the Gauley River National Recreation Area (GARI). Natural vegetation is defined as plant communities composed primarily of native species that develop in areas which are not significantly affected by human activities. Semi-natural vegetation is defined as plant communities composed primarily of native species that develop spontaneously (without human intervention) in areas that were significantly altered in the past by human activities. Semi-natural vegetation at GARI is usually characterized by even-aged stands of shade intolerant tree species which, over time, show signs of succession towards natural vegetation types adapted to the area. The key does not include 1) cultural vegetation (residential lawns, farmland, tree plantations, etc…), 2) development features (buildings, parking lots, roads, etc…), 3) areas which have been repeatedly or significantly impacted by human-caused disturbance (recently logged areas, recently abandoned farmland, utility and transportation corridors, etc…), 4) natural unvegetated areas (river-scoured bedrock, boulders, cobble, and sand), or 5) aquatic features (rivers, creeks, ponds).

For each final lead, the <u>GARI community type name</u> (underlined) is listed, followed by the corresponding [USNVC association name and code] (in brackets). **Map classes** (in bold) in which each vegetation type occurs are listed either following the vegetation type name, or in a previous lead if the map class includes all the vegetation types which follow that lead. The following map classes are not included in the key: **Creek, Developed Area, Disturbed Area, Pond, Road, Railroad**, and **Utility Corridor**. The map classes **Back Channel** and **River** are included in the key because they include small patches of the <u>American Water-willow Cobble Bar</u> community type, but their predominant aquatic communities are not included in the key. The map classes **Cliff Face, Successional (Virginia, Pitch) Pine Forest**, and **Riparian Zone** are each comprised of multiple vegetation types. The map class **Riparian Zone** also includes areas of unvegetated bedrock, boulder, cobble, sand, and water that are not included in the key.

1. Upland communities not including riparian jurisdictional uplands. Located on plateaus, ridges, gorge slopes and benches, in coves and ravines, on cliffs, and in positions along streams which are never flooded.
   1.1. Exposed bedrock cliff faces. Vascular plants, including trees, shrubs, and herbs, have sparse cover and are confined to growing in cracks or may overhang and provide partial shade. Highest cover is provided by nonvascular plants, including lichens and bryophytes. **Map class: Cliff Face**
      1.1.1. Cliff faces dominated by the macrolichen *Umbilicaria mammulata* (common rock tripe). Cliffs are usually less than vertical, with their faces exposed to water and light: <u>Common Rock Tripe Cliff Face</u> [*Umbilicaria mammulata* Nonvascular Vegetation (CEGL004387)]
      1.1.2. Cliff faces with less than 5% cover of *Umbilicaria mammulata* (common rock tripe), often dominated by sparse to heavy cover of crustose lichens. Cliffs are often vertical or with overhangs that reduce exposure to water and light: <u>Dry Cliff Face</u> [Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation (CEGL006435)]

1.2. Forests and woodlands. Vegetation dominated by trees. May occur on top of cliffs or may include small cliffs or ledges shaded by trees, but these do not provide a significant vertical or horizontal break in the forest canopy.

1.2.1. Mixed evergreen-deciduous forests and woodlands with a significant conifer component in the stand. Cover by conifers usually > 15% in the canopy layers. If conifer cover is < 15% in the canopy then conifers have higher cover in the surrounding stand and there is abundant conifer regeneration in the understory.

1.2.1.1. Species of *Pinus* (pine) dominant or codominant in the canopy.

1.2.1.1.1. Even-aged, successional forests on abandoned farmland, in areas excavated for dam construction, or on other disturbed sites. Evidence of succession may include break up of pine canopy and abundance of shade tolerant tree species, such as *Tsuga canadensis* (eastern hemlock) and *Fagus grandifolia* (American beech), in the subcanopy or shrub layers. **Map class: Successional (Virginia, Pitch) Pine Forest**

1.2.1.1.1.1. Stands dominated by *Pinus virginiana* (Virginia pine): <u>Successional Virginia Pine Forest</u> [*Pinus virginiana* Successional Forest (CEGL002591)]

1.2.1.1.1.2. Stands dominated by *Pinus rigida* (pitch pine): <u>Successional Pitch Pine Forest</u> [*Liriodendron tulipifera - Pinus strobus - Tsuga canadensis - Quercus (rubra, alba) / Polystichum acrostichoides* Forest (CEGL006304)]

1.2.1.1.2. Edaphic forests and woodlands on hot, dry, exposed cliff tops and rock outcrops. Canopies are often open and stunted and are dominated by *Pinus virginiana* (Virginia pine). Shrub layers usually have abundant *Vaccinium pallidum* (Blue Ridge blueberry) and/or *Gaylussacia baccata* (black huckleberry): <u>Cliff Top Virginia Pine Forest</u> [*Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum* Forest (CEGL007119)] **Map class: Cliff Top Virginia Pine Forest**

1.2.1.2. Species of *Pinus* (pine) absent or sparse in the canopy. *Tsuga canadensis* (eastern hemlock) is the most abundant conifer in the canopy.

1.2.1.2.1. *Rhododendron maximum* (great laurel) with >5% cover in the shrub layers, often forming nearly impenetrable thickets.

1.2.1.2.1.1. *Rhododendron catawbiense* (Catawba rosebay) common. Rare, small patch forest type on cliff tops and ledges: <u>Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest</u> [*Quercus prinus / Rhododendron catawbiense - Kalmia latifolia* Forest (CEGL008524)] **Map class: Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest**

1.2.1.2.1.2. *Rhododendron catawbiense* (Catawba rosebay) absent or sparse. Shrub layer dominated by *Rhododendron maximum* (great laurel).

1.2.1.2.1.2.1. *Betula alleghaniensis* var. *alleghaniensis* (yellow birch) with > 20% cover in the canopy layers. Rare, small patch type confined to cold positions in gorge bottoms: <u>Yellow Birch Cold Cove Forest</u> [*Betula alleghaniensis - (Tsuga*

canadensis) / Rhododendron maximum / (Leucothoe fontanesiana) Forest (CEGL007861)] **Map class: Yellow Birch Cold Cove Forest**

1.2.1.2.1.2.2. *Betula alleghaniensis* var. *alleghaniensis* (yellow birch) absent or sparse in the canopy layers. Matrix or large patch forest type on gorge and ravine slopes and bottoms, cliff tops, and other landforms: <u>Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest</u> [*Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543)] **Map class: Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest**

1.2.1.2.2. *Rhododendron maximum* (great laurel) absent or sparse. Large patch forest on upper slopes and plateaus: <u>Eastern Hemlock Plateau Forest</u> [*Liriodendron tulipifera - Pinus strobus - Tsuga canadensis - Quercus (rubra, alba) / Polystichum acrostichoides* Forest (CEGL006304] **Map class: Eastern Hemlock Plateau Forest**

1.2.2. Deciduous forests. Cover by conifers < 15% in the canopy and with little conifer regeneration in the understory.

1.2.2.1. Successional deciduous forests dominated by *Liriodendron tulipifera* (tuliptree), on land previously cleared for agriculture or subjected to heavy or repeated logging or other canopy replacing disturbance. Cover by *Liriodendron tulipifera* > 50% of total canopy cover: <u>Successional Tuliptree Forest</u> [*Liriodendron tulipifera - Quercus* spp. Forest (CEGL007221)] **Map class: Successional Tuliptree Forest**

1.2.2.2. Deciduous forests not dominated by *Liriodendron tulipifera* (tuliptree). If present, *Liriodendron tulipifera* contributes < 50% of total canopy cover.

1.2.2.2.1. Deciduous forests with canopies dominated by species of *Quercus* (oaks) and/or *Carya* (hickories). Species of *Quercus* or *Carya*, alone or in combination, comprising > 50% of total canopy cover.

1.2.2.2.1.1. Oak forests with well-developed shrub layers composed of species in the Ericaceae (heath family), including *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), and species of *Rhododendron* (azalea, laurel, rhododendron, rosebay), and *Vaccinium* (blueberry). Heaths, alone or in combination, comprising > 10% cover.

1.2.2.2.1.1.1. *Rhododendron catawbiense* (Catawba rosebay) with greater than 5% cover: <u>Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest</u> [*Quercus prinus / Rhododendron catawbiense - Kalmia latifolia* Forest (CEGL008524)] **Map class: Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest**

1.2.2.2.1.1.2. *Rhododendron catawbiense* (Catawba rosebay) absent or sparse.

1.2.2.2.1.1.2.1. Shrub layers dominated by *Rhododendron maximum* (great laurel), which often forms nearly impenetrable thickets. Occurs on n moister sites compared to the

next: Oak / Great Laurel Forest [*Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest (CEGL006286)] **Map class: Oak / Great Laurel Forest**

1.2.2.2.1.1.2.2. Shrub layers dominated by *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), and/or species of *Vaccinium* (blueberry): Occurs on drier sites compared to the last: Oak / Ericad Forest [*Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271)] **Map class: Oak / Ericad Forest**

1.2.2.2.1.2. Oak and oak-hickory forests without well developed shrub layers composed of species in the Ericaceae (heath family). Heaths, alone or in combination, comprising < 10% cover.

1.2.2.2.1.2.1. *Acer saccharum* var. *saccharum* (sugar maple) with greater cover than *Acer rubrum* (red maple). On moister or more fertile sites compared to the next: Oak - Hickory - Sugar Maple Forest [*Quercus prinus - Carya ovata - Quercus rubra / Acer saccharum* Forest (CEGL007268)] **Map class: Oak - Hickory - Sugar Maple Forest**

1.2.2.2.1.2.2. *Acer rubrum* (red maple) with greater cover than *Acer saccharum* var. *saccharum* (sugar maple). On dryer or less fertile sites compared to the last: Oak - Hickory Forest [*Quercus prinus - (Quercus rubra) - Carya spp. / Oxydendrum arboreum - Cornus florida* Forest (CEGL007267)] **Map class: Oak - Hickory Forest**

1.2.2.2.2. Deciduous forests not dominated by species of *Quercus* (oaks) or *Carya* (hickories).

1.2.2.2.2.1. Forests with > 20% cover by *Betula alleghaniensis* var. *alleghaniensis* (yellow birch) in the canopy and/or subcanopy. Rare, small patch type confined to cold positions in gorge bottoms: Yellow Birch Cold Cove Forest [*Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / (Leucothoe fontanesiana)* Forest (CEGL007861)] **Map class: Yellow Birch Cold Cove Forest**

1.2.2.2.2.2. *Betula alleghaniensis* var. *alleghaniensis* (yellow birch) absent or sparse. Forests codominated by various mixtures of mesophytic species including *Tilia americana* (American basswood), *Acer saccharum* var. *saccharum* (sugar maple), *Liriodendron tulipifera* (tuliptree), *Quercus rubra* (northern red oak), *Aesculus* flava (yellow buckeye), and *Fagus grandifolia* (American beech): Sugar Maple - Yellow Buckeye - American Basswood Forest [*Liriodendron tulipifera - Tilia americana* var. *heterophylla - Aesculus flava - Acer saccharum / (Magnolia tripetala)* Forest (CEGL005222)] **Map class: Sugar Maple - Yellow Buckeye - American Basswood Forest**

2. Riparian and wetland communities. Vegetation affected by flooding or seepage. Includes jurisdictional wetlands and other areas which are seasonally, temporarily, or occasionally flooded. Frequency of flooding may range from intervals of decades to semi-permanent. Located in slope bottom and level landscape positions on alluvial landforms.
    - 2.1. Seepage wetlands in the headwaters of small streams on the plateaus. Communities are shaded or partially shaded by trees rooted in the wetland and/or overhanging from adjacent upland forests: Forest Seep [*Acer rubrum - Nyssa sylvatica / Ilex verticillata - Vaccinium fuscatum / Osmunda cinnamomea* Forest (CEGL007853)] **Map class: Forest Seep.**
    - 2.2. Floodplain and riparian vegetation along rivers and large tributary streams.
        - 2.2.1. Open communities dominated by shrubs and/or herbs. Cover by trees greater than 6 meters tall < 20%.
            - 2.2.1.1. Small patch herbaceous wetlands with semi-permanently saturated or flooded soils. Vegetation is dominated by the wetland obligates *Sparganium* spp. (bur-reed) or *Justicia americana* (American water-willow).
                - 2.2.1.1.1. Herbaceous marsh dominated by a species of *Sparganium* (bur-reed). Rare, small patch community known from one site in a back channel at Iron Ring Rapids: Bur-reed Marsh [*Sparganium americanum - (Sparganium erectum* ssp. *stoloniferum) - Epilobium leptophyllum* Herbaceous Vegetation (CEGL004510)] **Map class: Bur-reed Marsh**
                - 2.2.1.1.2. Cobble bars in shallow water of river main channels and back channels dominated by *Justicia americana* (American water-willow): American Water-willow Cobble Bar [*Justicia americana* Herbaceous Vegetation (CEGL004286)] **Map classes: American Water-willow Cobble Bar, Back Channel, River, Riparian Zone**
            - 2.2.1.2. Small patch and linear zones of diverse shrub-prairie vegetation in frequently flooded positions along the shores of rivers and large tributaries. Common species in the shrub layers include *Ilex verticillata* (common winterberry), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), and saplings of *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore). Common herbs include *Andropogon gerardii* (big bluestem), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), and *Packera paupercula* (balsam groundsel): Riverscour Shrub Prairie [*(Betula nigra - Ilex verticillata) / Andropogon gerardii - Solidago simplex* var. *racemosa* Shrub Herbaceous Vegetation (CEGL006623)] **Map class: Riparian Zone.**
        - 2.2.2. Floodplain and riparian forests and woodlands. Cover by trees greater than 6 meters tall > 20%.
            - 2.2.2.1. Evergreen and mixed evergreen-deciduous forests and woodlands. Cover by conifers > 15% in the canopy layers.
                - 2.2.2.1.1. *Pinus virginiana* (Virginia pine) and/or *Pinus rigida* (pitch pine) are dominant in the canopy: (Virginia, Pitch) Pine Floodplain Forest [*Pinus virginiana - (Pinus rigida) - Nyssa sylvatica / Xanthorhiza simplicissima/ Euphorbia corollata* Forest (CEGL006624)] **Map class: (Virginia, Pitch) Pine Floodplain Forest**
                - 2.2.2.1.2. *Tsuga canadensis* (eastern hemlock) is the most abundant conifer in the canopy: Eastern Hemlock Floodplain Forest [*Tsuga canadensis -*

Quercus rubra - (Platanus occidentalis, Betula nigra) / Rhododendron maximum / Anemone quinquefolia Forest (CEGL006620)] **Map class: Eastern Hemlock Floodplain Forest**

2.2.2.2. Deciduous forests and woodlands. Cover by conifers < 15% in the canopy layers.

2.2.2.2.1. Riparian woodlands with total cover by trees < 60%. Canopy is kept somewhat open by frequent, high-energy floods. Dominant trees include *Platanus occidentalis* (American sycamore) and/or *Betula nigra* (river birch): American Sycamore - River Birch Riverscour Woodland [*Platanus occidentalis - Betula nigra / Cornus amomum / (Andropogon gerardii, Chasmanthium latifolium)* Woodland (CEGL003725)] **Map Classes: American Sycamore - River Birch Riverscour Woodland, Riparian Zone.** Two phases can be recognized:

2.2.2.2.1.1. Herbaceous layer dominated by *Chasmanthium latifolium* (Indian woodoats), *Dichanthelium clandestinum* (deertongue), and other tall herbs. Occurs on relatively fine textured alluvial deposits (sand). river birch / Indian woodoats phase

2.2.2.2.1.2. Herbaceous layer dominated by *Andropogon gerardii* (big bluestem) with *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod) and *Packera paupercula* (balsam groundsel) common. Occurs on relatively coarse textured alluvial deposits (boulders, cobbles, and sand). sycamore - river birch / big bluestem phase

2.2.2.2.2. Floodplain forests with total cover by trees > 60%. Stands subject to less frequent and/or lower-energy floods.

2.2.2.2.2.1. Forests in positions which are rarely flooded. Canopies with a significant component of *Quercus* (oak) species: Oak - Hickory Floodplain Forest [*Quercus (rubra, velutina, alba) / Carpinus caroliniana - (Halesia tetraptera) / Maianthemum racemosum* Forest (CEGL006462)] **Map class: Oak - Hickory Floodplain Forest**

2.2.2.2.2.2. Forests in positions which are more regularly flooded. Canopies without a significant component of *Quercus* (oak) species. Dominant trees include *Platanus occidentalis* (American sycamore) and/or *Liriodendron tulipifera* (tuliptree). *Liquidambar styraciflua* (sweetgum) is common: American Sycamore - Tuliptree - Sweetgum Floodplain Forest [*Liquidambar styraciflua - Liriodendron tulipifera / Lindera benzoin / Arisaema triphyllum* Forest (CEGL004418)] **Map class: American Sycamore - Tuliptree - Sweetgum Floodplain Forest**

Appendix J. Local and global vegetation association descriptions for Gauley River National Recreation Area.

INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Gauley River National Recreation Area

9 April 2010

by

NatureServe

1101 Wilson Blvd., 15th floor
Arlington, VA 22209

11 Avenue de Lafayette, 5th Floor
Boston, MA 02111-1736

This subset of the International Ecological Classification Standard covers vegetation associations attributed to Gauley River National Recreation Area. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Sue Gawler, Regional Ecologist, Boston, MA <sue_gawler@natureserve.org>.

NatureServe
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Citations:

The following citation should be used in any published materials which reference ecological system and/or International Vegetation Classification (IVC hierarchy) and association data:

NatureServe. 2010. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 9 April 2010.

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These data are extracted from:

NatureServe. 2010. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 9 April 2010.

This document may be generally cited as follows:

NatureServe[1]. 2010. International Ecological Classification Standard: Terrestrial Ecological Classifications. Associations of Gauley River National Recreation Area. NatureServe Central Databases. Arlington, VA. Data current as of 9 April 2010.

[1] NatureServe is an international organization including NatureServe regional offices, a NatureServe central office, U.S. State Natural Heritage Programs, and Conservation Data Centres (CDC) in Canada and Latin America and the Caribbean. Ecologists from the following organizations have contributed the development of the ecological systems classification:

United States
Central NatureServe Office, Arlington, VA; Eastern Regional Office, Boston, MA; Midwestern Regional Office, Minneapolis, MN; Southeastern Regional Office, Durham, NC; Western Regional Office, Boulder, CO; Alabama Natural Heritage Program, Montgomery AL; Alaska Natural Heritage Program, Anchorage, AK; Arizona Heritage Data Management Center, Phoenix AZ; Arkansas Natural Heritage Commission Little Rock, AR; Blue Ridge Parkway, Asheville, NC; California Natural Heritage Program, Sacramento, CA; Colorado Natural Heritage Program, Fort Collins, CO; Connecticut Natural Diversity Database, Hartford, CT; Delaware Natural Heritage Program, Smyrna, DE; District of Columbia Natural Heritage Program/National Capital Region Conservation Data Center, Washington DC; Florida Natural Areas Inventory, Tallahassee, FL; Georgia Natural Heritage Program, Social Circle, GA; Great Smoky Mountains National Park, Gatlinburg, TN; Gulf Islands National Seashore, Gulf Breeze, FL; Hawaii Natural Heritage Program, Honolulu, Hawaii; Idaho Conservation Data Center, Boise, ID; Illinois Natural Heritage Division/Illinois Natural Heritage Database Program, Springfield, IL; Indiana Natural Heritage Data Center, Indianapolis, IN; Iowa Natural Areas Inventory, Des Moines, IA; Kansas Natural Heritage Inventory, Lawrence, KS; Kentucky Natural Heritage Program, Frankfort, KY; Louisiana Natural Heritage Program, Baton Rouge, LA; Maine Natural Areas Program, Augusta, ME; Mammoth Cave National Park, Mammoth Cave, KY; Maryland Wildlife & Heritage Division, Annapolis, MD; Massachusetts Natural Heritage & Endangered Species Program, Westborough, MA; Michigan Natural Features Inventory, Lansing, MI; Minnesota Natural Heritage & Nongame Research and Minnesota County Biological Survey, St. Paul, MN; Mississippi Natural Heritage Program, Jackson, MI; Missouri Natural Heritage Database, Jefferson City, MO; Montana Natural Heritage Program, Helena, MT; National Forest in North Carolina, Asheville, NC; National Forests in Florida, Tallahassee, FL; National Park Service, Southeastern Regional Office, Atlanta, GA; Navajo Natural Heritage Program, Window Rock, AZ; Nebraska Natural Heritage Program, Lincoln, NE; Nevada Natural Heritage Program, Carson City, NV; New Hampshire Natural Heritage Inventory, Concord, NH; New Jersey Natural Heritage Program, Trenton, NJ; New Mexico Natural Heritage Program, Albuquerque , NM; New York Natural Heritage Program, Latham, NY; North Carolina Natural Heritage Program, Raleigh, NC; North Dakota Natural Heritage Inventory, Bismarck, ND; Ohio Natural Heritage Database, Columbus, OH; Oklahoma Natural Heritage Inventory, Norman, OK; Oregon Natural Heritage Program, Portland, OR; Pennsylvania Natural Diversity Inventory, PA; Rhode Island Natural Heritage Program, Providence, RI; South Carolina Heritage Trust, Columbia, SC; South Dakota Natural Heritage Data Base, Pierre, SD; Tennessee Division of Natural Heritage, Nashville, TN; Tennessee Valley Authority Heritage Program, Norris, TN; Texas Conservation Data Center, San Antonio, TX; Utah Natural Heritage Program, Salt Lake City, UT; Vermont Nongame & Natural Heritage Program, Waterbury, VT; Virginia Division of Natural Heritage, Richmond, VA; Washington Natural Heritage Program, Olympia, WA; West Virginia Natural Heritage Program, Elkins, WV; Wisconsin Natural Heritage Program, Madison, WI; Wyoming Natural Diversity Database, Laramie, WY

Canada
Alberta Natural Heritage Information Centre, Edmonton, AB, Canada; Atlantic Canada Conservation Data Centre, Sackville, New Brunswick, Canada; British Columbia Conservation Data Centre, Victoria, BC, Canada; Manitoba Conservation Data Centre. Winnipeg, MB, Canada; Ontario Natural Heritage Information Centre, Peterborough, ON, Canada; Quebec Conservation Data Centre, Quebec, QC, Canada; Saskatchewan Conservation Data Centre, Regina, SK, Canada; Yukon Conservation Data Centre, Yukon, Canada

Latin American and Caribbean
Centro de Datos para la Conservacion de Bolivia, La Paz , Bolivia; Centro de Datos para la Conservacion de Colombia, Cali,Valle, Columbia; Centro de Datos para la Conservacion de Ecuador, Quito, Ecuador; Centro de Datos para la Conservacion de Guatemala, Ciudad de Guatemala , Guatemala; Centro de Datos para la Conservacion de Panama, Querry Heights , Panama; Centro de Datos para la Conservacion de Paraguay, San Lorenzo , Paraguay; Centro de Datos para la Conservacion de Peru, Lima, Peru; Centro de Datos para la Conservacion de Sonora, Hermosillo, Sonora , Mexico; Netherlands Antilles Natural Heritage Program, Curacao , Netherlands Antilles; Puerto Rico-Departmento De Recursos Naturales Y Ambientales, Puerto Rico; Virgin Islands Conservation Data Center, St. Thomas, Virgin Islands.

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

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COMMON NAME (PARK-SPECIFIC): CLIFF TOP VIRGINIA PINE FOREST

SYNONYMS

USNVC English Name: **Virginia Pine - (Pitch Pine, Shortleaf Pine) - (Chestnut Oak) / Hillside Blueberry Forest**

USNVC Scientific Name: ***Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum* Forest**

USNVC Identifier: **CEGL007119**

LOCAL INFORMATION

Environmental Description: This association occurs on clifftops, ledges, and rocky slopes weathered from sandstone of the New River formation (Pottsville group). These sites have very high solar exposure and most occurrences have south to west aspects. Slopes in mapped polygons range from 5 to 49 degrees (mean = 33). Elevations in mapped polygons range from 231 to 555 m (mean = 324). Unvegetated ground cover is predominantly litter, bedrock, and large rocks. Soils are typically shallow over bedrock. Soils in plots are described as dry to very dry, well drained to rapidly drained sandy loam and sandy clay loam. Soils test very strongly to extremely acidic (mean pH =3.95) with relatively high levels of total exchange capacity, estimated N release, Al, and Fe, and relatively low levels of Ca, Cu, Mg, Mn, and Zn compared to average values from all plots in the park. Polygons of this association are usually found adjacent to larger polygons of Oak / Ericad Forest (CEGL006271), Oak - Hickory Forest (CEGL007267), or Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543), all of which occur in less xeric positions.

Vegetation Description: Stands of this association are evergreen or mixed evergreen-deciduous woodlands or forests dominated by *Pinus virginiana* (Virginia pine). The canopy is typically short (<20 m), and tree height and cover decrease with increasing severity of the site. *Pinus rigida* (pitch pine) occurs in some stands, and *Tsuga canadensis* (eastern hemlock) is often present with low cover. Associated deciduous trees include *Quercus coccinea* var. *coccinea* (scarlet oak), *Oxydendrum arboreum* (sourwood), *Acer rubrum* (red maple), *Quercus prinus* (chestnut oak), *Quercus alba* (white oak), and *Nyssa sylvatica* (blackgum). Shrub layers are usually well-developed and are dominated by species in the Ericaceae (heath family), including *Kalmia latifolia* (mountain laurel), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Rhododendron maximum* (great laurel), *Rhododendron catawbiense* (Catawba rosebay), and *Gaylussacia baccata* (black huckleberry). Additional common shrubs and vines include *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), and *Amelanchier arborea* var. *arborea* (common serviceberry). Tree regeneration in the shrub layers is dominated by deciduous species, but saplings of the conifers *Pinus virginiana* (Virginia pine), *Pinus rigida* (pitch pine), and *Tsuga canadensis* (eastern hemlock) occur in some plots. The ericaceous subshrubs *Gaultheria procumbens* (eastern teaberry) and *Epigaea repens* (trailing arbutus) have high constancy. The herb layer usually has low cover and species diversity. Herbs that occur in more than one plot include *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Mitchella repens* (partridgeberry), and *Danthonia spicata* (poverty oatgrass). State-rare herbs that occur in this association include *Danthonia sericea* (downy danthonia) and *Dichanthelium sabulorum* var. *thinium* (hemlock rosette grass). Additional characteristic herbs include *Dichanthelium linearifolium* (slimleaf panicgrass), *Dichanthelium dichotomum* var. *dichotomum* (cypress panicgrass), *Asplenium montanum* (mountain spleenwort), *Hieracium*

venosum (rattlesnakeweed), *Lycopodium tristachyum* (deeproot clubmoss), and *Carex pensylvanica* (Pennsylvania sedge). Vascular plant species richness in plots ranges from 19 to 32 taxa (mean = 23). Lichens and mosses are usually abundant. Lichens identified in plots include *Cladonia caroliniana* (Carolina cup lichen), *Cladonia squamosa* (cup lichen), *Cladina rangiferina* (greygreen reindeer lichen), *Cladonia pyxidata* (cup lichen), *Umbilicaria mammulata* (navel lichen), *Lasallia papulosa* (blistered naval lichen), *Lasallia pensylvanica* (Pennsylvania blistered naval lichen), *Xanthoparmelia plittii* (Plitt's rock-shield lichen), *Xanthoparmelia conspersa* (xanthoparmelia lichen), and *Flavoparmelia caperata* (lichen). Mosses identified in plots include *Leucobryum glaucum* (leucobryum moss), *Leucobryum albidum* (leucobryum moss), *Polytrichum juniperinum* (juniper polytrichum moss), *Dicranum scoparium* (dicranum moss), *Dicranum spurium* (dicranum moss), *Dicranum condensatum* (condensed dicranum moss), *Hypnum imponens* (hypnum moss), and *Thuidium delicatulum* (delicate thuidium moss).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	S2	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association occurs in small patches scattered throughout the length of the Meadow and Gauley gorges in the park. Most occurrences are on "river right" (on the right side looking downstream) due to the concentration of south to west aspects on this side of the rivers.
Classification Comments: In a combined analysis with all upland plots from Gauley River National Recreation Area (GARI), New River Gorge National River (NERI), and Bluestone National Scenic River (BLUE), plots of this association from GARI and NERI cluster together as a cohesive group, far away from plots of Virginia Pine - Oak Shale Woodland (CEGL008540) from BLUE. Stands of *Pinus virginiana* (Virginia pine) at GARI which have developed on previously cleared land (abandoned farmland, dam construction sites) are classified as Successional Virginia Pine Forest (CEGL002591). Stands of *Pinus virginiana* (Virginia pine) occurring on floodplains in GARI have much higher diversity in the herb and shrub layers and are classified as (Virginia, Pitch) Pine Floodplain Forest (CEGL006624).
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Six plots were sampled: GARI.45, GARI.57, GARI.66, GARI.74, GARI.181, and GARI.162.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b.)
Alliance	*Pinus virginiana* Forest Alliance (A.131)
Alliance (English name)	Virginia Pine Forest Alliance
Association	*Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum* Forest

Association (English name)	Virginia Pine - (Pitch Pine, Shortleaf Pine) - (Chestnut Oak) / Hillside Blueberry Forest
Ecological System(s):	Cumberland Sandstone Glade and Barrens (CES202.337). Central Interior Highlands Dry Acidic Glade and Barrens (CES202.692). Southern Appalachian Montane Pine Forest and Woodland (CES202.331). Southern Appalachian Low-Elevation Pine Forest (CES202.332). Central Appalachian Dry Oak-Pine Forest (CES202.591). Cumberland Acidic Cliff and Rockhouse (CES202.309). Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359). Central Appalachian Pine-Oak Rocky Woodland (CES202.600).

GLOBAL DESCRIPTION

Concept Summary: This community includes *Pinus virginiana* (Virginia pine)-dominated forests of low-elevation ridges and steep upper slopes, occurring primarily in the Appalachian provinces of the eastern United States, from central Pennsylvania, south and west to northern Georgia and northern Alabama. This community occurs on narrow ridges, steep slopes, and other topographic positions with high solar exposure, over shallow, infertile soils. This mainly evergreen forest is often of low stature, with a somewhat open to closed canopy, sparse to very dense shrub cover dominated by ericaceous species, and a sparse herb stratum. *Pinus virginiana* (Virginia pine) is the canopy dominant throughout the range of the type. In some parts of the range, other *Pinus* (pine) species may be significant canopy associates, as well as dry-site *Quercus* (oak) species (e.g., *Quercus prinus* (chestnut oak), *Quercus coccinea* (scarlet oak)). Deciduous species may form a subcanopy or sapling stratum, particularly in areas where fire has been excluded. Common shrub dominants include *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Gaylussacia baccata* (black huckleberry), and *Kalmia latifolia* (mountain laurel). Herbs vary with geography but are typical of infertile, xeric habitats. Some typical herbs in this forest are *Baptisia tinctoria* (horseflyweed), *Chimaphila maculata* (striped prince's pine), *Dichanthelium commutatum* (variable panicgrass), *Epigaea repens* (trailing arbutus), *Euphorbia corollata* (flowering spurge), *Galax urceolata* (beetleweed), *Gaultheria procumbens* (eastern teaberry), *Hypoxis hirsuta* (common goldstar), *Iris verna* (dwarf violet iris), *Pityopsis graminifolia* var. *latifolia* (narrowleaf silkgrass), *Pteridium aquilinum* var. *latiusculum* (western brackenfern), and *Schizachyrium scoparium* (little bluestem).

Environmental Description: Stands of this forest occur on narrow ridges and knobs, steep upper slopes, bluff and cliff tops, and other exposed sites throughout the range of the type. The community is found primarily on south-, southeast- or southwest-facing aspects on excessively drained, shallow soils. In the Blue Ridge Escarpment region, the western margin of the Blue Ridge, and west into the Ridge and Valley and Cumberland Mountains, this xeric forest occurs on convex slopes and ridges below 850 m (2800 ft) elevation, over soils classed as Inceptisols, typically Lithic Dystrochrepts originating from sandstone, shale and other noncalcareous parent material. Occurrences in rugged parts of the western Piedmont are also likely. Its environmental situation in the western Alleghenies is not known. In the Interior Low Plateau of Kentucky, Tennessee, and Indiana, this association occurs in edaphically extreme situations, including bluff tops and narrow ridges in thin soils weathered from relatively acidic caprocks with southern and western aspects, as well as other similar slopes, over cherty limestone, siltstones, sandstones, and shales. In particular, in the Knobstone Escarpment Subsection (a few Indiana counties just north of Louisville, Kentucky), it occurs in gladelike situations on steep slopes with thin soils. Along the edges of cliff tops, there is usually a narrow zone of exposed bedrock pavement and patches of very shallow soil, but soils become progressively deeper back from the cliff edge. At least in

West Virginia, portions of the stands along the cliff edge are likely to be edaphic climax communities, but farther back from the edge, they are likely to be successional following fire.

Vegetation Description: This community is a needle-leaved evergreen forest with a usually somewhat open (occasionally closed) canopy. The canopy is typically short (<20 m) with tree height and canopy cover decreasing with increasing severity of the microsite. A deciduous subcanopy may be present. The shrub layers can be sparse but are more often dense to very dense and are composed of tall and short shrubs, predominantly ericaceous species. Herb cover is sparse, and leaf litter often dominates the ground layer. *Pinus virginiana* (Virginia pine) is the canopy dominant throughout the range of the type. In the Southern Appalachians and Southern Ridge and Valley it may occur with mixes of *Pinus rigida* (pitch pine), *Pinus echinata* (shortleaf pine), or *Pinus strobus* (eastern white pine). Within its range, *Pinus pungens* (Table Mountain pine) may be present as a very minor component. Regeneration of *Pinus virginiana* (Virginia pine) is concentrated along cliff edges and tends to drop off inward from the edge. Small stems of *Quercus prinus* (chestnut oak), *Quercus coccinea* (scarlet oak), *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), and *Oxydendrum arboreum* (sourwood) are common in the subcanopy and sapling strata and may occur in the canopy as well. In the Southern Blue Ridge/Piedmont and Southern Blue Ridge/Ridge and Valley transition regions, *Quercus marilandica* (blackjack oak), *Quercus falcata* (southern red oak), and *Quercus stellata* (post oak) can be deciduous components. Common shrub dominants include *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Gaylussacia baccata* (black huckleberry), and *Kalmia latifolia* (mountain laurel). Other typical shrubs can include *Gaylussacia ursina* (bear huckleberry), *Kalmia latifolia* (mountain laurel), *Sassafras albidum* (sassafras), and *Vaccinium hirsutum* (hairy blueberry) (southwestern North Carolina and southeastern Tennessee only). *Smilax glauca* (cat greenbrier) and *Smilax rotundifolia* (roundleaf greenbrier) can be common vines. In the sparse herb layer, characteristic species from the Southern Blue Ridge and Southern Ridge and Valley include *Baptisia tinctoria* (horseflyweed), *Chimaphila maculata* (striped prince's pine), *Dichanthelium commutatum* (variable panicgrass), *Danthonia spicata* (poverty oatgrass), *Epigaea repens* (trailing arbutus), *Euphorbia corollata* (flowering spurge), *Galax urceolata* (beetleweed), *Gaultheria procumbens* (eastern teaberry), *Hypoxis hirsuta* (common goldstar), *Iris verna* (dwarf violet iris), *Pityopsis graminifolia* var. *latifolia* (narrowleaf silkgrass), *Pteridium aquilinum* var. *latiusculum* (western brackenfern), and *Schizachyrium scoparium* (little bluestem). Typical herbs from examples in the western portion of the range (Interior Low Plateau) include *Antennaria plantaginifolia* (woman's tobacco), *Antennaria solitaria* (singlehead pussytoes), *Carex albicans* var. *albicans* (whitetinge sedge), *Danthonia spicata* (poverty oatgrass), *Dichanthelium dichotomum* (cypress panicgrass), *Lespedeza violacea* (violet lespedeza), *Hieracium gronovii* (queendevil), *Hieracium venosum* (rattlesnakeweed), *Krigia biflora* (twoflower dwarfdandelion), *Solidago erecta*, and *Tephrosia virginiana* (Virginia tephrosia) (M. Homoya pers. comm. 1999). In some of these examples *Opuntia humifusa* (devil's-tongue), *Calamagrostis porteri* ssp. *insperata* (Porter's reedgrass), and *Solidago squarrosa* (stout goldenrod) may occur locally. Nonvascular plants have not been documented rangewide; West Virginia examples have identified lichen species including *Cladonia caroliniana* (Carolina cup lichen), *Cladonia squamosa* (cup lichen), *Cladina rangiferina* (greygreen reindeer lichen), *Cladonia pyxidata* (cup lichen), *Umbilicaria mammulata* (navel lichen), *Lasallia papulosa* (blistered naval lichen), *Lasallia pensylvanica* (Pennsylvania blistered naval lichen), *Xanthoparmelia plittii* (Plitt's rock-shield lichen), *Xanthoparmelia conspersa* (xanthoparmelia moss), and *Flavoparmelia caperata* (lichen), and moss species including

Leucobryum glaucum (leucobryum moss), *Leucobryum albidum* (leucobryum moss), *Polytrichum juniperinum* (juniper polytrichum moss), *Dicranum scoparium* (dicranum moss), *Dicranum spurium*, *Dicranum condensatum* (condensed dicranum moss), *Hypnum imponens* (hypnum moss), and *Thuidium delicatulum* (delicate thuidium moss).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus rigida* (pitch pine) *Pinus virginiana* (Virginia pine)
Tree canopy	Broad-leaved deciduous tree	*Quercus coccinea* var. *coccinea* (scarlet oak) *Quercus prinus* (chestnut oak)
Tall shrub/sapling	Broad-leaved evergreen shrub	*Kalmia latifolia* (mountain laurel)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry) *Vaccinium pallidum* (Blue Ridge blueberry) *Vaccinium stamineum* (deerberry)

Characteristic Species: *Cladonia caroliniana* (Carolina cup lichen), *Comptonia peregrina* (sweet fern), *Epigaea repens* (trailing arbutus), *Gaultheria procumbens* (eastern teaberry), *Leucobryum glaucum* (leucobryum moss), *Oxydendrum arboreum* (sourwood), *Pinus virginiana* (Virginia pine), *Pteridium aquilinum* (western brackenfern), *Sassafras albidum* (sassafras), *Schizachyrium scoparium* var. *scoparium* (little bluestem).

Other Noteworthy Species:

Species	GRank	Type	Note
Buckleya distichophylla (piratebush)	G3	plant	globally imperiled
Calamagrostis porteri ssp. *insperata* (Porter's reedgrass)	G4T3	plant	
Cleistes bifaria (small spreading pogonia)	-	plant	
Coreopsis pulchra (woodland tickseed)	G2	plant	globally imperiled Cumberland Plateau endemic
Cuscuta harperi (Harper's dodder)	G2G3	plant	
Diervilla rivularis (mountain bush honeysuckle)	G3	plant	
Gaylussacia brachycera (box huckleberry)	G3	plant	
Helianthus longifolius (longleaf sunflower)	G3	plant	rare Cumberland Plateau endemic
Penstemon deamii (Deam's beardtongue)	G1	plant	globally critically imperiled
Rudbeckia heliopsidis (sunfacing coneflower)	G2	plant	globally imperiled
Sabatia capitata (Appalachian rose gentian)	G2	plant	globally imperiled Cumberland Plateau endemic
Talinum mengesii (Menges' fameflower)	G3	plant	
Thermopsis villosa (Aaron's rod)	G3?	plant	
Vaccinium hirsutum (hairy blueberry)	G3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community occurs primarily in the Appalachian region of the United States, ranging from central Pennsylvania, south and west through the Ridge and Valley, Blue Ridge, and Cumberland Plateau to northern Georgia and Alabama, extending westward to scattered areas in the Interior Low Plateau and eastward into the upper Piedmont. It is recorded from the states of Georgia, North Carolina, South Carolina, Tennessee, Kentucky, Pennsylvania, Indiana, Ohio, Maryland, Virginia, and West Virginia.

States/Provinces: AL, GA, IN, KY, MD, NC, OH, PA, SC, TN, VA, WV:S2.

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Appalachian Trail, Big South Fork, Blue Ridge Parkway, Chickamauga-Chattanooga, Gauley River, Great Smoky Mountains, Kennesaw Mountain, Kings Mountain?, Little River Canyon, Mammoth Cave, New River Gorge, Obed); USFS (Bankhead, Chattahoochee, Chattahoochee (Piedmont), Chattahoochee

(Southern Blue Ridge), Cherokee, Daniel Boone, Land Between the Lakes?, Nantahala, Pisgah, Sumter, Sumter (Mountains), Sumter (Piedmont), Talladega, Talladega (Oakmulgee), Talladega (Talladega), Wayne).

CONSERVATION STATUS

Rank: G4? (4-Feb-2010).

Reasons: This xeric evergreen forest community will be maintained on sites where local soil conditions and topographic extremes function to retard hardwood invasion. Infestations of southern pine beetle (*Dendroctonus frontalis*) can cause mortality of canopy trees. Examples affected by southern pine beetle in the Great Smoky Mountains can have up to 80–90% standing dead pine.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 1 - Strong.

Comments: Some vegetation formerly placed (at least conceptually) in the *Pinus virginiana - Quercus (coccinea, prinus)* Forest Alliance (A.408) has been transferred here, with this association (CEGL007119) becoming more geographically inclusive. In Indiana examples, the substrate is primarily a matrix of acidic siltstone, shale, and sandstone. Rarely are cliffs formed; instead the setting is mostly very steep slopes with high hills and deep ravines. This association also includes vegetation from the transition between the Cumberland Plateau / Southern Ridge and Valley and the Upper East Gulf Coastal Plain in Alabama. Though located in the Coastal Plain, these occurrences are physiographically and floristically similar to this montane association.

Early-successional vegetation associated with old fields, old pastures, clearcuts, and burned or eroded areas and dominated by *Pinus virginiana* (Virginia pine) is classified as *Pinus virginiana* (Virginia pine) Successional Forest (CEGL002591). Appalachian xeric oak forests with similar floristics, but with a mainly deciduous canopy, are classed in *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271). Appalachian shale forests and woodlands with *Pinus virginiana* (Virginia pine) occur on steep, shaly slopes and have stunted canopies and sparse herb and shrub strata, characterized by species adapted to shaly substrates. These shale communities are classed in *Pinus virginiana - Quercus (coccinea, prinus)* Forest Alliance (A.408) and *Pinus (rigida, pungens, virginiana) - Quercus prinus* Woodland Alliance (A.677). In 13 plots from the Southern Blue Ridge, species with ≥54% constancy and at least 10% mean cover are *Pinus virginiana* (Virginia pine), *Vaccinium pallidum* (Blue Ridge blueberry), *Quercus prinus* (chestnut oak), *Oxydendrum arboreum* (sourwood), *Acer rubrum* (red maple), *Quercus coccinea* (scarlet oak), *Nyssa sylvatica* (blackgum), *Pinus rigida* (pitch pine), *Gaylussacia baccata* (black huckleberry), and *Gaylussacia ursina* (bear huckleberry).

Similar Associations:

- *Pinus (rigida, echinata) - Quercus coccinea / Ilex opaca* Woodland (CEGL006115).
- *Pinus echinata* Early-Successional Forest (CEGL006327).
- *Pinus pungens - Pinus rigida - (Quercus prinus) / Kalmia latifolia - Vaccinium pallidum* Woodland (CEGL007097).
- *Pinus virginiana - (Pinus rigida) - Nyssa sylvatica / Xanthorhiza simplicissima / Euphorbia corollata* Forest (CEGL006624).
- *Pinus virginiana - (Pinus rigida, Pinus pungens) / Schizachyrium scoparium* Forest (CEGL008500)--has a more open structure with relatively well-developed herbaceous stratum, often graminoid-dominated.

- *Pinus virginiana - Quercus falcata - Carya pallida* Forest (CEGL006354).
- *Pinus virginiana / Quercus marilandica* Serpentine Forest (CEGL006266).
- *Pinus virginiana* Successional Forest (CEGL002591)--is distinguished from this community by differences in land-use history; CEGL002591 exists in flat to moderately sloping land that was heavily plowed in the recent past (10–60 years), whereas this community is generally a product of less disturbed soils and more historic disturbance by fire or logging without plowing.
- *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271).
- *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023).

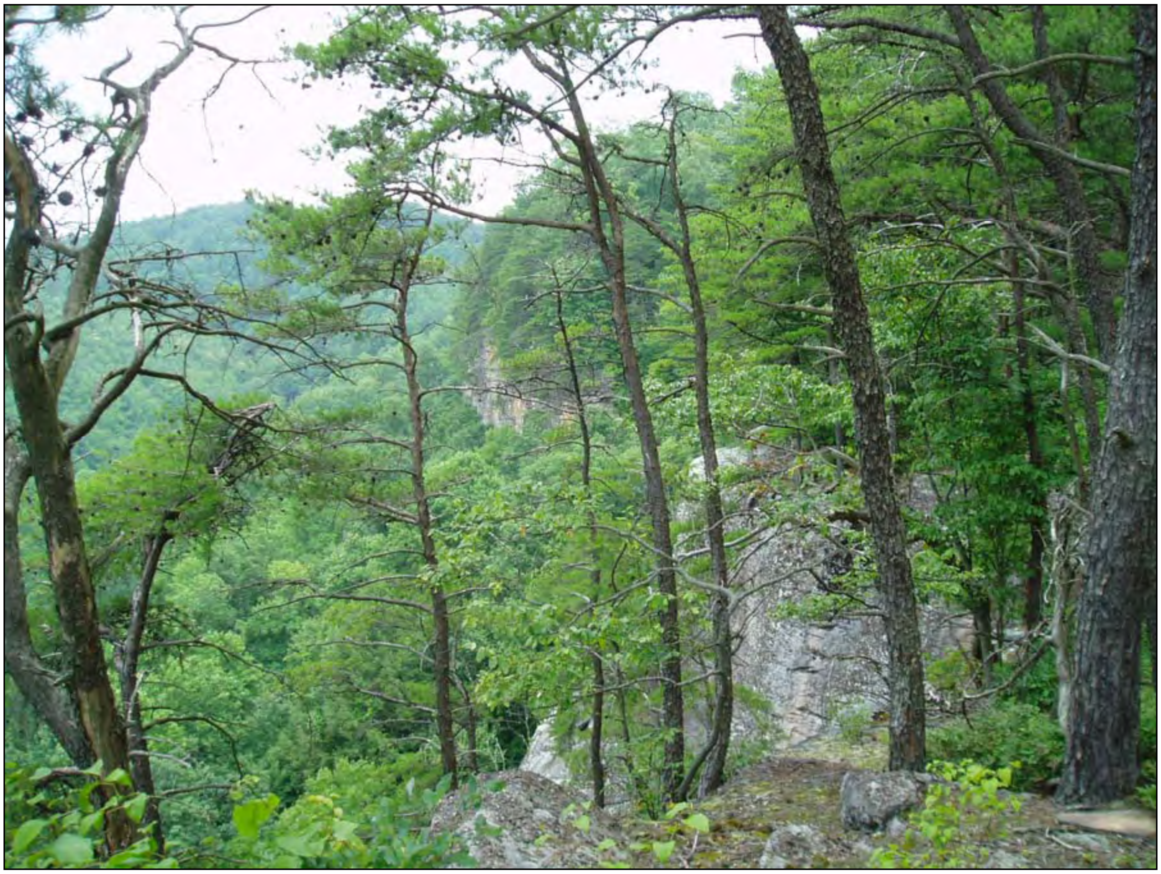
Related Concepts:

- *Pinus virginiana - (Quercus* spp.) / *Nyssa sylvatica / Gaultheria procumbens* forest (Vanderhorst 2002b) =
- *Pinus virginiana - Quercus prinus - Nyssa sylvatica* Forest (Walton et al. 1997) ?
- IA7c. Xeric Virginia Pine Ridge Forest (Allard 1990) B
- Low Mountain Pine Forest (Montane Pine Subtype) (Schafale 1998b) ?
- Oligotrophic Forest (Rawinski 1992) B
- Virginia Pine - Mixed Oaks, HR (Pyne 1994) B
- Virginia Pine - Oak: 78 (Eyre 1980) B
- Virginia Pine Type (Schmalzer and DeSelm 1982) B
- Virginia Pine, BR, R&V, CUPL (Pyne 1994) B
- Virginia Pine: 79 (Eyre 1980) B
- Virginia pine forest (CAP pers. comm. 1998) ?
- Xeric Pine Forest, Pine - Heath Ridge Forest (Ambrose 1990a) B

SOURCES

Description Authors: K. D. Patterson, mod. R. White and S. C. Gawler.

References: Allard 1990, Ambrose 1990a, Barden 1977, Burns and Honkala 1990a, CAP pers. comm. 1998, Cooper 1963, Core 1966, Evans 1991, Eyre 1980, Faller 1975, Fike 1999, Fleming and Patterson 2009a, Gettman 1974, Harrison 2004, Homoya pers. comm., Malter 1977, Maxwell 2006, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Patterson et al. 1999, Peet et al. unpubl. data 2002, Pyne 1994, Racine 1966, Rawinski 1992, Schafale 1998b, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2002b, Vanderhorst et al. 2007, Vanderhorst et al. 2010, Walton et al. 1997, Whittaker 1956.


Plot GARI.66. Cliff Top Virginia Pine Forest.

COMMON NAME (PARK-SPECIFIC): SUCCESSIONAL VIRGINIA PINE FOREST

SYNONYMS

USNVC English Name: **Virginia Pine Successional Forest**
USNVC Scientific Name: ***Pinus virginiana* Successional Forest**
USNVC Identifier: **CEGL002591**

LOCAL INFORMATION

Environmental Description: This association occurs in small to large patches in areas subjected to clearing and ground disturbance in the past, including abandoned farmland and dam excavation sites. Most stands are on gentle topography on plateaus. Sites usually have convex topography or warm aspects and have high solar exposure. Bedrock geology is mapped as sandstones and shales of the New River and Kanawha formations of the Pottsville group. Slopes in mapped polygons range from 0 to 32 degrees (mean = 6). Elevations in mapped polygons range from 297 to 540 m (mean = 468). Unvegetated ground cover is mostly litter (pine needles) with some downed woody debris. Higher accumulations of woody debris in older stands can make foot travel difficult. Soils in plots on abandoned farmland are described as dry to somewhat moist, well-drained sandy loam and sandy clay. Soils on the dam excavation sites were stripped away and the substrate is essentially unweathered bedrock; soil from a plot was described as somewhat moist, moderately-drained silty clay loam. Soils test very strongly to extremely acidic (mean pH = 4.6) with relatively high levels of total exchange capacity, S, Al, and P and relatively low levels of organic matter, estimated N release, Cu, Mg, Mn, Na, and Zn compared to average values from all plots in the park. Adjacent vegetation often includes Successional Tuliptree Forest (CEGL007221), which develops in more mesic positions on abandoned farmland, and Eastern Hemlock Plateau Forest (CEGL006304), the natural climax vegetation which persists in areas that were not cleared. Adjacent vegetation at two sites is Successional Pitch Pine Forest which is classified as CEGL006304. Ecological reasons for the establishment of *Pinus virginiana* (Virginia pine) vs. *Pinus rigida* (pitch pine) on similar adjacent sites is obscure but may be related to fire regime, proximity of seed sources, and timing of farm abandonment.

Vegetation Description: This successional forest represents even-aged stands of *Pinus virginiana* (Virginia pine) which developed in areas following canopy removal and ground disturbance. Older stands on abandoned farmland have tall canopies (>20 m) of decadent *Pinus virginiana* (Virginia pine) overtopping the shade-tolerant *Tsuga canadensis* (eastern hemlock), which often dominates the subcanopy and shrub layers. Scattered *Pinus rigida* (pitch pine) may be mixed in these stands. Associated deciduous trees which occur in the canopy layers include *Liriodendron tulipifera* (tuliptree), *Oxydendrum arboreum* (sourwood), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Acer rubrum* (red maple), *Betula lenta* (sweet birch), and *Prunus serotina* var. *serotina* (black cherry). Except for regeneration of *Tsuga canadensis* (eastern hemlock), the shrub and herb layers are usually sparse. These stands appear to be succeeding towards Eastern Hemlock Plateau Forest (CEGL006304), a local natural forest type. Stands which occur on dam excavation sites have somewhat different structure and composition. Their canopies are short (<15 m) and apparently stunted, and there is little evidence of succession towards a local natural vegetation type. Shrub, herb, and bryophyte diversity is higher than in stands on farmland, probably due to higher light levels in the understory. Shrubs in these stands include *Ilex opaca* (American holly), *Gaylussacia baccata* (black huckleberry), and

Vaccinium pallidum (Blue Ridge blueberry), and the herb layer is characterized by weedy natives and exotics such as *Lycopodium digitatum* (fan clubmoss), *Achillea millefolium* var. *occidentalis* (western yarrow), *Hieracium caespitosum* (meadow hawkweed), and *Lespedeza cuneata* (Chinese lespedeza). The bryophyte layer in these stands may have high cover by *Dicranum scoparium* (dicranum moss), *Polytrichum commune* (polytrichum moss), and other mosses. There are a couple wetland indicators in the herb and bryophyte layers, and ruderal wetlands occur as small inclusions within these stands. Vascular plant species richness in all plots ranges from 13 to 33 (mean = 22.2).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNA	=	1	[gname]	WVNHP unpubl. data b

Local Range: Stands of this association are confined to areas on the plateaus which were disturbed by past human activities.

Classification Comments: In a cluster analysis, the one plot from a dam excavation site (GARI.50) grouped as an outlier with plots of the Cliff Top Virginia Pine Forest (CEGL007119), probably due to presence of trace amounts of shrubs of the Ericaceae (heath family). However, these stands are placed in CEGL002591 because they occur on land which was severely impacted by human activities and they are not considered natural vegetation.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Three plots were sampled: GARI.50, GARI.59, and GARI.61.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b.)
Alliance	*Pinus virginiana* Forest Alliance (A.131)
Alliance (English name)	Virginia Pine Forest Alliance
Association	*Pinus virginiana* Successional Forest
Association (English name)	Virginia Pine Successional Forest
Ecological System(s):	Southern Appalachian Low-Elevation Pine Forest (CES202.332). Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074).

GLOBAL DESCRIPTION

Concept Summary: This successional Virginia pine forest of the southeastern states occurs in areas where canopy removal has created dry, open conditions and bare mineral soil, allowing for the establishment of *Pinus virginiana* (Virginia pine). These habitats include old fields, old pastures, clearcuts, and eroded areas; soils are typically dry, acidic, and infertile. It is common on abandoned farmland. This forest typically has a very dense canopy of *Pinus virginiana* (Virginia pine) and little understory vegetation. The dense canopy may also include admixtures of other *Pinus* (pine) species (e.g., *Pinus taeda* (loblolly pine), *Pinus echinata* (shortleaf pine), *Pinus*

strobus (eastern white pine)) or other early-successional deciduous trees (e.g., *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Prunus serotina* (black cherry), *Liriodendron tulipifera* (tuliptree), *Fraxinus americana* (white ash), *Nyssa sylvatica* (blackgum)). Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species. Shrub and herb layers are frequently very sparse. Stands are short-lived, generally less than 75 years.

Environmental Description: This community occurs in areas where canopy removal has created open conditions and bare mineral soil, allowing for the establishment of *Pinus virginiana* (Virginia pine). These conditions can include old fields, old pastures, clearcuts, and eroded areas. In the Ridge and Valley of Tennessee, northeastern Monroe County, early successional forests with *Pinus virginiana* (Virginia pine) dominance were found on low slopes in areas that were cleared for agriculture prior to the 1970s, when Tellico Lake was created (Andreu and Tukman 1995). In the Central Appalachians, this vegetation occurs where soft shales have been farmed (in valleys or on plateaus), resulting in stands with nothing but successional species in the understory. Soils underlying these communities are of two general types, i.e., those derived in residuum from calcareous shale and calcareous sandstone of the Middle Ordovician and those of some other origin. Series of the former type include Dandridge (Lithic Ruptic-Alfic Eutrochrepts), Tellico (Typic Rhododults), and Steekee (Ruptic-Ultic Dystrochrepts). Other soil series that this forest type may occur on include Litz, Dewey, Alcoa, Bland, Etowah, Lobdell and Neubert. All of these soils are well-drained and range in pH from moderate acidic to very strongly acidic.

Vegetation Description: This forest typically has a very dense canopy of *Pinus virginiana* (Virginia pine) and little understory vegetation. *Pinus taeda* (loblolly pine), *Pinus echinata* (shortleaf pine), or *Pinus strobus* (eastern white pine) may co-occur with *Pinus virginiana* (Virginia pine) in the canopy. The canopy can also have significant admixtures of early-successional deciduous trees (e.g., *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Prunus serotina* (black cherry), *Liriodendron tulipifera* (tuliptree), *Fraxinus americana* (white ash), *Oxydendrum arboreum* (sourwood), *Betula lenta* (sweet birch), *Nyssa sylvatica* (blackgum)). Older stands on abandoned farmland may have tall canopies (>20 m) of decadent *Pinus virginiana* (Virginia pine) overtopping the shade-tolerant *Tsuga canadensis* (eastern hemlock), which often dominates the subcanopy and shrub layers. Scattered *Pinus rigida* (pitch pine) may be mixed in these stands. Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species; *Lonicera japonica* (Japanese honeysuckle) and *Rosa multiflora* (multiflora rose) are common. The herb layer is characterized by weedy natives and exotics such as *Lycopodium digitatum* (fan clubmoss), *Achillea millefolium* var. *occidentalis* (western yarrow), *Hieracium caespitosum* (meadow hawkweed), and *Lespedeza cuneata* (Chinese lespedeza). Shrub and herb strata, where present at all, are usually sparse in coverage. In eastern Tennessee, the subcanopy may contain *Acer saccharum* (sugar maple) and *Cornus florida* (flowering dogwood); other associated species may include *Cercis canadensis* (eastern redbud), *Parthenocissus quinquefolia* (Virginia creeper), *Lonicera japonica* (Japanese honeysuckle), and *Microstegium vimineum* (Nepalese browntop) (Andreu and Tukman 1995). In the Central Appalachians, associates include *Pinus strobus* (eastern white pine), *Pinus echinata* (shortleaf pine), and *Pinus rigida* (pitch pine). Some stands may have a dense ericaceous shrub stratum containing *Vaccinium* (blueberry) spp., *Gaylussacia* (huckleberry) spp., *Kalmia latifolia* (mountain laurel), and *Rhododendron* (rhododendron) spp.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus virginiana* (Virginia pine)
Tree subcanopy	Needle-leaved tree	*Juniperus virginiana* (eastern red-cedar)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple) *Cornus florida* (flowering dogwood) *Nyssa sylvatica* (blackgum) *Oxydendrum arboreum* (sourwood)
Tall shrub/sapling	Broad-leaved deciduous tree	*Cornus florida* (flowering dogwood) *Nyssa sylvatica* (blackgum) *Oxydendrum arboreum* (sourwood)
Tall shrub/sapling	Broad-leaved evergreen tree	*Vaccinium arboreum* (farkleberry)
Tall shrub/sapling	Needle-leaved shrub	*Tsuga canadensis* (eastern hemlock)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium stamineum* (deerberry)
Short shrub/sapling	Broad-leaved deciduous tree	*Cercis canadensis* (eastern redbud) *Cornus florida* (flowering dogwood) *Oxydendrum arboreum* (sourwood) *Quercus alba* (white oak) *Sassafras albidum* (sassafras)
Herb (field)	Vine/Liana	*Lonicera japonica* (Japanese honeysuckle) *Smilax glauca* (cat greenbrier) *Toxicodendron radicans* (eastern poison ivy)

Characteristic Species: *Pinus virginiana* (Virginia pine), *Tsuga canadensis* (eastern hemlock).

Other Noteworthy Species:

Species	GRank	Type	Note
Albizia julibrissin (silktree)	-	plant	exotic
Lonicera japonica (Japanese honeysuckle)	-	plant	exotic
Microstegium vimineum (Nepalese browntop)	-	plant	exotic
Pueraria montana var. *lobata* (kudzu)	-	plant	exotic
Rosa multiflora (multiflora rose)	-	plant	exotic

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This successional community is possible in the Piedmont from Pennsylvania south to Alabama and ranges west into the Appalachians, Ridge and Valley, the Cumberland Plateau, and in scattered locales of the Interior Low Plateau.

States/Provinces: AL, DC?, DE, GA, IN, KY, MD, NC, NJ, PA, SC, TN, VA, WV.

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Abe Lincoln Birthplace, Appomattox Court House, Big South Fork, Blue Ridge Parkway?, Bluestone, Booker T. Washington, C&O Canal, Cumberland Gap, Fredericksburg-Spotsylvania, Gauley River, George Washington Parkway, Gettysburg, Great Smoky Mountains, Guilford Courthouse, Kings Mountain, Little River Canyon, Mammoth Cave, Manassas?, Natchez Trace, National Capital-East?, New River Gorge, Obed, Prince William?, Shenandoah, Shiloh, Thomas Stone, Wolf Trap); TVA (Tellico); USFS (Bankhead, Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Cherokee, Daniel Boone, George Washington, Jefferson, Monongahela, Sumter, Sumter (Mountains), Sumter (Piedmont), Uwharrie?).

CONSERVATION STATUS

Rank: GNA (ruderal) (13-Jun-2000).

Reasons: This forest represents early-successional vegetation and is thus not of high conservation concern.

Classification Information

Status: Standard.

Confidence: 1 - Strong.

Comments: Early-successional *Pinus virginiana* (Virginia pine) vegetation occurring over calcareous substrates is classed in *Pinus virginiana - Juniperus virginiana* var. *virginiana - Ulmus alata* Forest (CEGL007121) and has species indicative of calcareous substrates.

Similar Associations:

- *Pinus echinata* Early-Successional Forest (CEGL006327)--occurs in similar environments but is dominated (>50% of canopy) by *Pinus echinata* instead of *Pinus virginiana*.
- *Pinus taeda - Liquidambar styraciflua* Semi-natural Forest (CEGL008462)--is commonly found in the same area as CEGL002591 in the Piedmont. CEGL008462 contains at least 50% *Pinus taeda* in the canopy, whereas CEGL002591 is mostly *Pinus virginiana*.
- *Pinus taeda / Liquidambar styraciflua - Acer rubrum* var. *rubrum / Vaccinium stamineum* Forest (CEGL006011)--occurs in similar environments with similar disturbance histories but is dominated by (>50% of canopy) *Pinus taeda* instead of *Pinus virginiana*.
- *Pinus virginiana - Juniperus virginiana* var. *virginiana - Ulmus alata* Forest (CEGL007121)--on more calcareous or circumneutral substrates.
- *Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum* Forest (CEGL007119)--can have a very similar canopy in the Piedmont and Blue Ridge ecoregions, but CEGL007119 is generally created and maintained by fire and/or logging but not heavy plowing and/or erosion. CEGL002591 generally has signs of heavy agricultural use such as sparse herbaceous or shrub layers, large percentage of invasive exotics such as *Lonicera japonica* in the herbaceous layer, old plowlines, human debris, and extremely even-aged canopy, whereas CEGL007119 generally has a more intact herbaceous/shrub layer (especially *Vaccinium pallidum*) and less signs of severe human disturbance.

Related Concepts:

- *Pinus virginiana* forest (Vanderhorst 2001b) =
- IA7c. Xeric Virginia Pine Ridge Forest (Allard 1990) B
- Pine-Oak Association of the Western Shore District (Shreve et al. 1910) B
- Successional / Modified Terrestial Forest (Fleming et al. 2006) B
- Unclassified Old-Field Successional Forest (Fleming and Moorhead 2000) ?
- Virginia Pine - Oak: 78 (Eyre 1980) B
- Virginia Pine Type (Schmalzer and DeSelm 1982) B
- Virginia Pine, RV (Pyne 1994) B
- Virginia Pine: 79 (Eyre 1980) B
- Virginia pine successional forest (Collins and Anderson 1994) =
- Xeric Pine Forest (Ambrose 1990a) B

Sources

Description Authors: M. Andreu and M. Tukman, mod. J. P Vanderhorst, K. D. Patterson and S. C. Gawler.

References: Allard 1990, Ambrose 1990a, Andreu and Tukman 1995, Burns and Honkala 1990a, Collins and Anderson 1994, Coxe 2009, Eyre 1980, Faller 1975, Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 2000, Fleming et al. 2006, Hall and Mathews 1974, Nelson 1986, Patterson et al. 1999, Pyne 1994, Schmalzer and DeSelm 1982, Schotz pers. comm., Shreve et al. 1910, Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC 1998c, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2008, Vanderhorst et al. 2010, Young et al. 2006.


Plot GARI.61. Successional Virginia Pine Forest.

COMMON NAME (PARK-SPECIFIC): (VIRGINIA, PITCH) PINE FLOODPLAIN FOREST

SYNONYMS

USNVC English Name: **Virginia Pine - (Pitch Pine) - Blackgum / Yellowroot / Flowering Spurge Forest**

USNVC Scientific Name: ***Pinus virginiana - (Pinus rigida) - Nyssa sylvatica / Xanthorhiza simplicissima / Euphorbia corollata* Forest**

USNVC Identifier: **CEGL006624**

LOCAL INFORMATION

Environmental Description: This association occurs in well-drained positions on floodplains that are hypothesized to be subject to occasional high-energy, stand-replacing floods. Sites are located at knickpoints, or constrictions, which are associated with rapids and bends in the river. Solar exposure of sites is relatively high, especially compared to other gorge bottom communities; most sites occur on river right in positions with southerly exposures. Slopes in mapped polygons range from 0.7 to 18 degrees (mean = 12). Elevations in mapped polygons range from 214 to 401 m (mean = 264). Some sites do not appear to flood regularly but others have evidence (flotsam, sediment accumulation) of frequent flooding. Stands occur on bedrock, boulder, cobble, and sand substrates. Bedrock and boulders provide structure and microsites which facilitate establishment and survival of xerophytic trees and shrubs in frequently flooded sites. In plots that are infrequently flooded, unvegetated ground cover is dominated by litter; in plots that are more frequently flooded, it is dominated by rock, sand, and flotsam. Soils in plots are described as temporarily flooded, well-drained sand and sandy loam. Soils test strongly to slightly acidic (mean pH = 5.3) with relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, Ca, K, and P compared to average values from all plots in the park. Adjacent vegetation includes Riverscour Shrub Prairie (CEGL006623) and American Sycamore - River Birch Riverscour Woodland (CEGL003725), which occupy more frequently flooded positions, and American Sycamore - Tuliptree - Sweetgum Floodplain Forest (CEGL004418), Eastern Hemlock Floodplain Forest (CEGL006620), and Oak - Hickory Floodplain Forest (CEGL006462), which occupy positions that are less prone to catastrophic floods.

Vegetation Description: This association is a mixed evergreen-deciduous floodplain forest or woodland dominated by *Pinus virginiana* (Virginia pine) and/or *Pinus rigida* (pitch pine). Floristic composition of stands is an unusual mix of xerophytic and flood-tolerant species. Tree canopies are tall or somewhat stunted and canopy cover in plots ranges from 30 to 70%. Canopy trees, in addition to the dominant pines, include *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Liriodendron tulipifera* (tuliptree), *Quercus prinus* (chestnut oak), *Quercus alba* (white oak), and *Platanus occidentalis* (American sycamore). Subcanopy cover in plots ranges from 0 to 60%. Additional trees which are common in the subcanopy include *Tsuga canadensis* (eastern hemlock), *Ilex opaca* var. *opaca* (American holly), *Oxydendrum arboreum* (sourwood), *Chionanthus virginicus* (white fringetree), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), and *Betula nigra* (river birch). Shrub species in plots include *Hamamelis virginiana* (American witchhazel), *Rhododendron maximum* (great laurel), *Kalmia latifolia* (mountain laurel), *Lindera benzoin* (northern spicebush), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), and *Xanthorhiza simplicissima* (yellowroot). There is often regeneration of *Pinus*

virginiana (Virginia pine) in the shrub layers. The herb layer is usually diverse, in sharp contrast to xeric upland associations dominated by *Pinus virginiana* (Virginia pine) or *Pinus rigida* (pitch pine). Common herbs in plots include *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), *Potentilla canadensis* var. *canadensis* (dwarf cinquefoil), *Pedicularis canadensis* ssp. *canadensis* (Canadian lousewort), *Packera aurea* (golden ragwort), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Zizia aptera* (meadow zizia), *Viola pedata* (birdfoot violet), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Packera paupercula* (balsam groundsel), *Hypoxis hirsuta* (common goldstar), *Euphorbia corollata* (flowering spurge), *Deschampsia flexuosa* var. *flexuosa* (wavy hairgrass), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), and *Sorghastrum nutans* (Indiangrass). Vascular plant species diversity in plots ranges from 32 to 70 taxa (mean = 56.2). Bryophytes identified in plots include *Dicranum scoparium* (dicranum moss), *Bryoandersonia illecebra* (bryoandersonia moss), *Grimmia pilifera* (grimmia dry rock moss), *Hypnum imponens* (hypnum moss), *Leucobryum albidum* (leucobryum moss), *Leucobryum glaucum* (leucobryum moss), and *Thuidium delicatulum* (delicate thuidium moss). Lichens identified in plots include *Xanthoparmelia plittii* (Plitt's rock-shield lichen) and *Parmotrema hypotropum* (parmotrema lichen).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	.	.	[not crosswalked]	.

Local Range: A few stands of this association are widely scattered along the length of the Gauley River in the park. Most stands are on river right (on the right looking downstream) and occur in the western third of the park.
Classification Comments: Recognition of this new association is supported by data from 11 plots along four rivers in West Virginia. Canopy dominance of this association is similar to Cliff Top Virginia Pine Forest (CEGL007119), but it differs by its occurrence on floodplains and by having much higher diversity in the shrub and herb layers, including many species tolerant of flood disturbance. A single plot from New River Gorge at Sandstone Falls (NERI.92) that was previously classified (Vanderhorst et al. 2007) as a variant of *Platanus occidentalis - Betula nigra / Cornus amomum / (Andropogon gerardii*, *Chasmanthium latifolium)* Woodland (CEGL003725) is probably better classified as this association.
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Six plots were sampled: GARI.6, GARI.18, GARI.88, GARI.127, GARI.129, and GARI.217.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)

Formation	Temporarily flooded temperate or subpolar needle-leaved evergreen forest (I.A.8.N.e.)
Alliance	*Tsuga canadensis - (Pinus strobus)* Temporarily Flooded Forest Alliance (A.171)
Alliance (English name)	Eastern Hemlock - (Eastern White Pine) Temporarily Flooded Forest Alliance
Association	*Pinus virginiana - (Pinus rigida) - Nyssa sylvatica / Xanthorhiza simplicissima / Euphorbia corollata* Forest
Association (English name)	Virginia Pine - (Pitch Pine) - Blackgum / Yellowroot / Flowering Spurge Forest
Ecological System(s):	Central Appalachian Stream and Riparian (CES202.609).

GLOBAL DESCRIPTION

Concept Summary: This association occurs in narrow bands along high-energy floodplain gorges of a few rivers in West Virginia. Sites are located at constrictions associated with rapids and bends in the river. Solar exposure is relatively high for the gorge setting; most known sites occur in positions with southerly exposures. Substrates include bedrock, boulder, cobble, and sand. Soils are acidic, well-drained sand to sandy loam. Vegetation is a mixed evergreen-deciduous forest or woodland dominated by *Pinus virginiana* (Virginia pine) and/or *Pinus rigida* (pitch pine), with associated species forming an unusual mix of xerophytic and flood-tolerant species. The canopy varies from tall to somewhat stunted, with 30 to 70% cover. Canopy trees, in addition to the dominant pines, include *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Liriodendron tulipifera* (tuliptree), *Quercus prinus* (chestnut oak), *Quercus alba* (white oak), and *Platanus occidentalis* (American sycamore). Other trees that are common in the subcanopy include *Tsuga canadensis* (eastern hemlock), *Ilex opaca* var. *opaca* (American holly), *Oxydendrum arboreum* (sourwood), *Chionanthus virginicus* (white fringetree), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), and *Betula nigra* (river birch). Shrub species include *Hamamelis virginiana* (American witchhazel), *Rhododendron maximum* (great laurel), *Kalmia latifolia* (mountain laurel), *Lindera benzoin* (northern spicebush), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), and *Xanthorhiza simplicissima* (yellowroot). There is often regeneration of *Pinus virginiana* (Virginia pine) in the shrub layers. The herb layer is usually diverse, in sharp contrast to xeric upland associations dominated by *Pinus virginiana* (Virginia pine) or *Pinus rigida* (pitch pine). Common herbs in plots include *Rudbeckia laciniata* (cutleaf coneflower), *Potentilla canadensis* (dwarf cinquefoil), *Pedicularis canadensis* (Canadian lousewort), *Packera aurea* (golden ragwort), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Zizia aptera* (meadow zizia), *Viola pedata* (birdfoot violet), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Packera paupercula* (balsam groundsel), *Hypoxis hirsuta* (common goldstar), *Euphorbia corollata* (flowering spurge), *Deschampsia flexuosa* (wavy hairgrass), *Schizachyrium scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), and *Sorghastrum nutans* (Indiangrass).

Environmental Description: This association occurs in well-drained positions on floodplains that are hypothesized to be subject to occasional high-energy, stand-replacing floods. Sites are located at knickpoints, or constrictions, which are associated with rapids and bends in the river. Solar exposure of sites is relatively high, especially compared to other gorge bottom communities; most sites occur in positions with southerly exposures. Slopes at Gauley River occurrences range from 0.7 to 18 degrees (mean = 12) and elevations range from 214 to 401 m (mean = 264). Some sites do not appear to flood regularly but others have evidence (flotsam, sediment accumulation) of frequent flooding. Stands occur on bedrock, boulder, cobble, and sand substrates. Bedrock and boulders provide structure and microsites which facilitate establishment and survival of xerophytic trees and shrubs in frequently flooded sites. In areas that are infrequently flooded, unvegetated ground cover is dominated by litter; in areas that are more

frequently flooded, it is dominated by rock, sand, and flotsam. Soils are temporarily flooded, well-drained sand and sandy loam. Soils test strongly to slightly acidic (mean pH = 5.3) with relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, Ca, K, and P.

Vegetation Description: This association is a mixed evergreen-deciduous floodplain forest or woodland dominated by *Pinus virginiana* (Virginia pine) and/or *Pinus rigida* (pitch pine). Floristic composition is an unusual mix of xerophytic and flood-tolerant species. Tree canopies are tall or somewhat stunted and canopy cover ranges from 30 to 70%. Canopy trees, in addition to the dominant pines, include *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Liriodendron tulipifera* (tuliptree), *Quercus prinus* (chestnut oak), *Quercus alba* (white oak), and *Platanus occidentalis* (American sycamore). Subcanopy cover ranges from 0 to 60%. Additional trees that are common in the subcanopy include *Tsuga canadensis* (eastern hemlock), *Ilex opaca* var. *opaca* (American holly), *Oxydendrum arboreum* (sourwood), *Chionanthus virginicus* (white fringetree), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), and *Betula nigra* (river birch). Shrub species include *Hamamelis virginiana* (American witchhazel), *Rhododendron maximum* (great laurel), *Kalmia latifolia* (mountain laurel), *Lindera benzoin* (northern spicebush), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), and *Xanthorhiza simplicissima* (yellowroot). There is often regeneration of *Pinus virginiana* (Virginia pine) in the shrub layers. The herb layer is usually diverse, in sharp contrast to xeric upland associations dominated by *Pinus virginiana* (Virginia pine) or *Pinus rigida* (pitch pine). Common herbs include *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), *Potentilla canadensis* var. *canadensis* (dwarf cinquefoil), *Pedicularis canadensis* ssp. *canadensis* (Canadian lousewort), *Packera aurea* (golden ragwort), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Zizia aptera* (meadow zizia), *Viola pedata* (birdfoot violet), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Packera paupercula* (balsam groundsel), *Hypoxis hirsuta* (common goldstar), *Euphorbia corollata* (flowering spurge), *Deschampsia flexuosa* var. *flexuosa* (wavy hairgrass), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), and *Sorghastrum nutans* (Indiangrass). Vascular plant species diversity in six plots sampled along the Gauley River range from 32 to 70 taxa (mean = 56.2). Bryophytes identified in the Gauley River plots include *Dicranum scoparium* (dicranum moss), *Bryoandersonia illecebra* (bryoandersonia moss), *Grimmia pilifera* (grimmia dry rock moss), *Hypnum imponens* (hypnum moss), *Leucobryum albidum* (leucobryum moss), *Leucobryum glaucum* (leucobryum moss), and *Thuidium delicatulum* (delicate thuidium moss); lichens include *Xanthoparmelia plittii* (Plitt's rock-shield lichen) and *Parmotrema hypotropum* (parmotrema lichen).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus rigida* (pitch pine)
		Pinus virginiana (Virginia pine)
Herb (field)	Forb	*Lysimachia quadrifolia* (whorled yellow loosestrife)
Herb (field)	Graminoid	*Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Andropogon gerardii* (big bluestem), *Carpinus caroliniana* (American hornbeam), *Deschampsia flexuosa* (wavy hairgrass), *Hamamelis virginiana* (American witchhazel), *Hypoxis hirsuta* (common goldstar), *Kalmia latifolia* (mountain laurel), *Liriodendron tulipifera* (tuliptree), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Nyssa sylvatica* (blackgum), *Packera aurea* (golden ragwort), *Packera paupercula* (balsam groundsel), *Pedicularis canadensis* (Canadian lousewort), *Physocarpus opulifolius* (common ninebark),

Pinus rigida (pitch pine), *Pinus virginiana* (Virginia pine), *Platanus occidentalis* (American sycamore), *Quercus alba* (white oak), *Rhododendron maximum* (great laurel), *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), *Schizachyrium scoparium* (little bluestem), *Viola pedata* (birdfoot violet), *Zizia aptera* (meadow zizia).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION
Range: This association is currently known from the Gauley, Greenbrier, New, and Tygart's Valley rivers, on the west slope of the Eastern Continental Divide in West Virginia.
States/Provinces: WV.
Federal Lands: NPS (Gauley River).

CONSERVATION STATUS
Rank: GNR (4-Feb-2010).
Reasons: More information on the distribution of this association is needed to assign a global rank.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 3 - Weak.
Comments: Recognition of this new association (February 2010) is supported by data from eleven plots along four rivers in West Virginia. Canopy dominance of this association is similar to *Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum* Forest (CEGL007119), but it differs by its occurrence on floodplains and by having much higher diversity in the shrub and herb layers, including many species tolerant of flood disturbance. A single plot from New River Gorge at Sandstone Falls (NERI.92) that was previously classified (Vanderhorst et al. 2007) as a variant of *Platanus occidentalis - Betula nigra / Cornus amomum / (Andropogon gerardii, Chasmanthium latifolium)* Woodland (CEGL003725) is probably better classified as this association.
Similar Associations:
- *Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum* Forest (CEGL007119).

Related Concepts: Information not available.

SOURCES
Description Authors: S. C. Gawler.
References: Eastern Ecology Working Group n.d., Vanderhorst et al. 2007, Vanderhorst et al. 2010.


Plot GARI.217. (Virginia, Pitch) Pine Floodplain Forest.

COMMON NAME (PARK-SPECIFIC): EASTERN HEMLOCK FLOODPLAIN FOREST

SYNONYMS

USNVC English Name: **Eastern Hemlock - Northern Red Oak - (American Sycamore, River Birch) / Great Laurel / Nightcaps Forest**

USNVC Scientific Name: ***Tsuga canadensis - Quercus rubra - (Platanus occidentalis, Betula nigra) / Rhododendron maximum / Anemone quinquefolia* Forest**

USNVC Identifier: **CEGL006620**

LOCAL INFORMATION

Environmental Description: This association occurs in small patches on higher floodplains which are infrequently flooded or which are subjected to more frequent low-energy floods. In the steep-sided gorges of the Meadow and Gauley rivers, these are usually very narrow zones, but a few larger patches occur on islands and point bars. Solar exposure of these sites is relatively low. Slopes in mapped polygons range from 0 to 30 degrees (mean = 12). Elevations in mapped polygons range from 207 to 502 m (mean = 304). Fluvial features which help identify this as a floodplain community include alluvial substrate, levees, swales, flotsam (including tires), and scoured tree bases. Unvegetated ground cover in most plots is dominated by litter with lesser amounts of wood, rocks, and sand, but one more frequently (or more recently) flooded plot has 60% exposed sand and only 10% litter. There may be a gradient of increasing litter depth from the river to the upland side of this community related to flooding frequency and energy. Soils in plots are described as temporarily flooded or somewhat moist, deep sand, loamy sand, and sandy loam. Soils test medium to extremely acidic (mean pH = 4.57) with relatively high levels of Fe and relatively low levels of organic matter, Al, Ca, K, Mg, Mn, and P compared to average values from all plots in the park. Adjacent riparian associations which occur in more frequently flooded positions include (Virginia, Pitch) Pine Floodplain Forest (CEGL006624), American Sycamore - River Birch Riverscour Woodland (CEGL003725), and Riverscour Shrub Prairie (CEGL006623). Adjacent upland vegetation is usually Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543) or Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222).

Vegetation Description: This association is a mixed evergreen-deciduous floodplain forest or woodland codominated by *Tsuga canadensis* (eastern hemlock) in the canopy or subcanopy. Associated deciduous trees with high constancy in plots include *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Betula lenta* (sweet birch), *Quercus rubra* (northern red oak), *Betula nigra* (river birch), *Oxydendrum arboreum* (sourwood), and *Nyssa sylvatica* (blackgum). Decadent *Pinus rigida* (pitch pine) occurs in a few plots and may indicate succession from (Virginia, Pitch) Pine Floodplain Forest (CEGL006624). There is usually a well-developed tall-shrub layer dominated by *Rhododendron maximum* (great laurel). Additional common tall shrubs include *Hamamelis virginiana* (American witchhazel), *Ilex opaca* var. *opaca* (American holly), *Kalmia latifolia* (mountain laurel), and *Carpinus caroliniana* ssp. *virginiana* (American hornbeam). The short, rhizomatous shrub *Xanthorhiza simplicissima* (yellowroot) is often abundant, especially closer to the river's edge. The herb layer has sparse to moderate cover and is composed of a mixture of typically upland and riparian species. Herbs with high constancy in plots include *Polystichum acrostichoides* (Christmas fern), *Mitchella repens* (partridgeberry), *Dryopteris intermedia* (intermediate woodfern), *Eurybia divaricata* (white wood aster),

Maianthemum racemosum ssp. *racemosum* (feathery false lily of the valley), *Anemone quinquefolia* var. *quinquefolia* (nightcaps), *Thelypteris noveboracensis* (New York fern), *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), and *Osmunda regalis* var. *spectabilis* (royal fern). Vascular plant species richness in plots ranges from 20 to 70 taxa (mean = 48). The bryophyte layer has sparse to heavy cover. Bryophytes identified in plots include *Thuidium delicatulum* (delicate thuidium moss), *Leucobryum glaucum* (leucobryum moss), *Hypnum imponens* (hypnum moss), *Bazzania trilobata (common bazzania liverwort)*, *Dicranum scoparium* (dicranum moss), *Hypnum curvifolium* (curveleaf hypnum moss), *Bryoandersonia illecebra* (bryoandersonia moss), *Scapania nemorea*, and *Tetraphis pellucida* (tetraphis moss).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association occurs in small patches scattered along the Gauley and Meadow rivers throughout their lengths in the park but is less common along the highest gradient reaches of the Upper Gauley.
Classification Comments: Walton and Anderson (1997) described a *Tsuga canadensis - Betula nigra / Rhododendron* woodland from GARI which overlaps with the concept of this association. Their type has woodland physiognomy and many species that are more typical of American Sycamore - River Birch Riverscour Woodland (CEGL003725) and Riverscour Shrub Prairie (CEGL006623) as presented in this classification. Recognizing CEGL006620 as a floodplain forest association distinct from the riverscour types appears to be the most parsimonious solution based on patterns observed along multiple rivers in West Virginia.
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Eleven plots were sampled**:** GARI.7, GARI.14, GARI.41, GARI.48, GARI.68, GARI.119, GARI.122, GARI.149, GARI.154, GARI.171, and GARI.213.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Temporarily flooded temperate or subpolar needle-leaved evergreen forest (I.A.8.N.e.)
Alliance	*Tsuga canadensis - (Pinus strobus)* Temporarily Flooded Forest Alliance (A.171)
Alliance (English name)	Eastern Hemlock - (Eastern White Pine) Temporarily Flooded Forest Alliance
Association	*Tsuga canadensis - Quercus rubra - (Platanus occidentalis, Betula nigra) / Rhododendron maximum / Anemone quinquefolia* Forest
Association (English name)	Eastern Hemlock - Northern Red Oak - (American Sycamore, River Birch) / Great Laurel / Nightcaps Forest
Ecological System(s):	South-Central Interior Large Floodplain (CES202.705).

GLOBAL DESCRIPTION

Concept Summary: This association is a mixed evergreen-deciduous floodplain forest, usually with a somewhat open canopy, with *Tsuga canadensis* (eastern hemlock) prominent in the canopy and/or subcanopy. It occurs in small patches on higher floodplains of medium-sized streams which are infrequently flooded. Along smaller streams, stands may occur in positions subject to more frequent, low-energy floods. Mature stands along rivers may represent late-successional vegetation on stabilized terraces, but succession may be reversed by renewed scouring and bank erosion as rivers migrate across their floodplains. Microtopography is characterized by fluvial features including levees and swales. Codominant trees include *Tsuga canadensis* (eastern hemlock), *Acer rubrum* var. *rubrum* (red maple), and *Quercus rubra* (northern red oak). Mature stands have *Tsuga canadensis* (eastern hemlock) codominant in the canopy layer, but younger stands may have dominance by this shade-tolerant species in the lower strata. Additional trees include *Liriodendron tulipifera* (tuliptree), *Betula lenta* (sweet birch), *Fagus grandifolia* (American beech), *Fraxinus pennsylvanica* (green ash), *Robinia pseudoacacia* (black locust), and *Sassafras albidum* (sassafras). Tree species that characterize this association as a floodplain forest, including *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch), usually occur at low cover. Shrub layers may have moderate to dense cover and are dominated by *Rhododendron maximum* (great laurel). Herb layers are sparse and species-poor but usually include a few species more typical of floodplains than of upland hemlock forests, such as *Amphicarpaea bracteata* (American hogpeanut), *Arisaema triphyllum* (Jack in the pulpit), *Cryptotaenia canadensis* (Canadian honewort), and *Rudbeckia laciniata* (cutleaf coneflower).

Environmental Description: This association occurs in small patches on higher floodplains of medium-sized streams which are infrequently flooded. Along smaller streams, stands may occur in positions subject to more frequent, low-energy floods. Mature stands along rivers may represent late-successional vegetation on stabilized terraces, but succession may be reversed by renewed scouring and bank erosion as rivers migrate across their floodplains. Microtopography is characterized by fluvial features including levees and swales. In West Virginia, plot sampled stands of this association occur at elevations ranging from 207 to 632 m (675–2073 ft). Unvegetated ground cover is typically dominated by litter but may also include coarse woody debris (flotsam) and exposed sand and rock in more recently flooded examples. Soils are temporarily flooded, well-drained, deep, stone-free sand with a thin surficial duff layer, and test medium to extremely acidic.

Vegetation Description: This association is a mixed evergreen-deciduous floodplain forest, usually with a somewhat open canopy, codominated by *Tsuga canadensis* (eastern hemlock) in the canopy and/or subcanopy. Trees along the river's edge often lean towards and eventually topple into the river as the banks are undercut. Codominant trees include *Liriodendron tulipifera* (tuliptree), *Acer rubrum* var. *rubrum* (red maple), and *Quercus rubra* (northern red oak). Mature stands have *Tsuga canadensis* (eastern hemlock) codominant in the canopy layer, but younger stands may have dominance by this shade-tolerant species in the lower strata. Additional trees include *Betula lenta* (sweet birch), *Fagus grandifolia* (American beech), *Fraxinus pennsylvanica* (green ash), *Oxydendrum arboreum* (sourwood), and *Nyssa sylvatica* (blackgum). Tree species that characterize this association as a floodplain forest, including *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), and *Liquidambar styraciflua* (sweetgum), usually occur at low cover. Shrub layers may have moderate to dense cover. In some areas, the shrub layer is dominated by *Rhododendron maximum* (great laurel) and in some areas the short,

rhizomatous shrub *Xanthorhiza simplicissima* (yellowroot) may be abundant. Herb layers are sparse and species-poor but usually include a few species more typical of floodplains than of upland hemlock forests. Herbs include *Anemone quinquefolia* (nightcaps), *Amphicarpaea bracteata* (American hogpeanut), *Arisaema triphyllum* (Jack in the pulpit), *Aristolochia macrophylla* (pipevine), *Carex plantaginea* (plantainleaf sedge), *Conopholis americana* (American squawroot), *Cryptotaenia canadensis* (Canadian honewort), *Dryopteris intermedia* (intermediate woodfern), *Eurybia divaricata* (white wood aster), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Mitchella repens* (partridgeberry), *Osmorhiza claytonii* (Clayton's sweetroot), *Osmunda regalis* var. *spectabilis* (royal fern), *Parthenocissus quinquefolia* (Virginia creeper), *Polygonatum pubescens* (hairy Solomon's seal), *Polystichum acrostichoides* (Christmas fern), and *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
		Betula lenta (sweet birch)
		Liriodendron tulipifera (tuliptree)
		Quercus rubra (northern red oak)
Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	*Rhododendron maximum* (great laurel)
Herb (field)	Vine/Liana	*Aristolochia macrophylla* (pipevine)
Herb (field)	Forb	*Arisaema triphyllum* (Jack in the pulpit)

Characteristic Species: *Anemone quinquefolia* (nightcaps), *Betula nigra* (river birch), *Carex plantaginea* (plantainleaf sedge), *Liquidambar styraciflua* (sweetgum), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Mitchella repens* (partridgeberry), *Osmunda regalis* var. *spectabilis* (royal fern), *Platanus occidentalis* (American sycamore), *Thuidium delicatulum* (delicate thuidium moss), *Xanthorhiza simplicissima* (yellowroot).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association is currently known from floodplains of medium-sized streams west of the Eastern Continental Divide in West Virginia, including the Bluestone, Gauley, Greenbrier, and Shavers Fork rivers and their tributaries.

States/Provinces: WV.

Federal Lands: NPS (Bluestone, Gauley River); USFS (Monongahela).

CONSERVATION STATUS

Rank: GNR (14-Nov-2007).

Reasons: The area occupied by this association has probably been greatly decreased by conversion of upper floodplains for agriculture and other human uses from the late 1700s through the mid-1900s. *Tsuga canadensis* (eastern hemlock) is currently threatened by the exotic insect hemlock woolly adelgid (*Adelges tsugae*). Many hemlocks are already dead in floodplains along the Greenbrier River, and this insect pest is known from the Bluestone River, while trees along the Shavers Fork still appear healthy. Along the Gauley River, occurrences of this association are impacted by camping associated with whitewater rafting. There are currently insufficient data to assign a numeric rank.

Classification Information

Status: Standard.

Confidence: 3 - Weak.

Comments: This association is classified based on data from 14 plots from the Bluestone, Gauley, and Shavers Fork rivers in West Virginia. It has also been observed along the Greenbrier River and some of its tributaries (e.g., Anthony Creek) and from tributaries of the Shavers Fork River (e.g., Pheasant Run). It is floristically similar to upland mixed deciduous-hemlock forests (e.g., *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543)), but the presence of floodplain species and contrasting disturbance and successional dynamics support its recognition as a distinct association. Its potential range is larger than currently described, and data from other areas would help increase confidence in the type.

Similar Associations:

- *Tsuga canadensis - (Pinus strobus)* Temporarily Flooded Forest (CEGL007143).

Related Concepts:

- *Tsuga canadensis - Betula nigra / Rhododendron* woodland (Walton and Anderson 1997) I

Sources

Description Authors: S. C. Gawler, mod. J. Vanderhorst.

References: Eastern Ecology Working Group n.d., Perez pers. comm., Vanderhorst et al. 2008, Vanderhorst et al. 2010, Walton and Anderson 1997.

Plot GARI.171. Eastern Hemlock Floodplain Forest.

COMMON NAME (PARK-SPECIFIC): SUGAR MAPLE - YELLOW BUCKEYE - AMERICAN BASSWOOD FOREST

SYNONYMS

USNVC English Name: **Tuliptree - Appalachian Basswood - Yellow Buckeye - Sugar Maple / (Umbrella-tree) Forest**

USNVC Scientific Name: ***Liriodendron tulipifera - Tilia americana* var. *heterophylla - Aesculus flava - Acer saccharum / (Magnolia tripetala)* Forest**

USNVC Identifier: **CEGL005222**

LOCAL INFORMATION

Environmental Description: This association occurs in small to large patches on gorge slopes with relatively cool aspects and moist, fertile soils. Solar exposure of these sites is low, slopes are mostly steep, and aspects are mostly northwest to north to east. Slopes in mapped polygons range from 0 to 49 degrees (mean = 25). Elevations in mapped polygons range from 212 to 596 m (mean = 400). Bedrock geology is mapped as sandstones and shales of the Kanawha and New River formations of the Pottsville group. This association is more abundant on gorge slopes of the lower Gauley River (downstream from Wood's Ferry), reflecting greater exposure of the Kanawha formation. Unvegetated ground cover is dominated by litter and large rocks with lesser amounts of downed woody debris. Soils in plots are described as well-drained, somewhat moist to moist loam, sandy loam, silt loam, and sandy clay loam. Soil in one plot may be classified as a folist, characterized by a deep organic horizon (duff) over bouldery colluvium. Soils test slightly to extremely acidic (mean pH = 4.76) with relatively high levels of total exchange capacity, estimated N release, Ca, K, Mg, and Zn, and relatively low levels of Fe compared to average values from all plots in the park. Adjacent associations include Oak - Hickory Forest (CEGL007267) and Oak - Hickory - Sugar Maple Forest (CEGL007268) which occur in somewhat warmer, drier slope positions, and Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543) which is the matrix forest on gorge slopes of the middle to upper Gauley and Meadow rivers in the park.

Vegetation Description: This association is a mostly deciduous forest composed of a diverse mixture of tree species adapted to mesic conditions. Canopies are tall (>20 m). Canopy cover in plots ranges from 50 to 80% and subcanopy cover ranges from 20 to 70%. Codominant trees include (in decreasing order of constancy in plots) *Acer saccharum* var. *saccharum* (sugar maple), *Quercus rubra* (northern red oak), *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), *Tilia americana* (American basswood), *Fraxinus americana* (white ash), *Fagus grandifolia* (American beech), *Magnolia acuminata* (cucumber-tree), *Tsuga canadensis* (eastern hemlock), *Ulmus rubra* (slippery elm), and *Aesculus flava* (yellow buckeye). Vines, which may reach into the canopy, include *Vitis aestivalis* (summer grape) and *Aristolochia macrophylla* (pipevine). Common shrubs include *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush), *Rhododendron maximum* (great laurel), *Asimina triloba* (pawpaw), and *Cercis canadensis* var. *canadensis* (eastern redbud). Cover in the herb layer of plots ranges from 20 to 80%. Common herbs include (in decreasing order of constancy in plots) *Polystichum acrostichoides* (Christmas fern), *Laportea canadensis* (Canadian woodnettle), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), *Dryopteris marginalis* (marginal woodfern), *Dryopteris intermedia* (intermediate woodfern), *Viola canadensis* (Canadian white violet), *Tiarella cordifolia* (heartleaf foamflower), *Eurybia divaricata* (white wood aster), *Galium*

triflorum (fragrant bedstraw), *Osmorhiza claytonii* (Clayton's sweetroot), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Asarum canadense* (Canadian wildginger), *Ageratina altissima* var. *altissima* (white snakeroot), *Geranium maculatum* (spotted geranium), *Actaea racemosa* var. *racemosa* (black bugbane), and *Botrychium virginianum* (rattlesnake fern). Vascular plant species richness in plots ranges from 28 to 68 taxa (mean = 46.8). Nonvascular cover in plots ranges from 0 to 80%, generally dominated by bryophytes. Bryophytes identified in more than one plot include *Thuidium delicatulum* (delicate thuidium moss), *Brachythecium oxycladon* (brachythecium moss), *Anomodon attenuatus* (anomodon moss), *Loeskeobryum brevirostre* (loeskeobryum moss), *Dicranum fulvum* (dicranum moss), *Aulacomnium heterostichum* (aulacomnium moss), *Rhodobryum ontariense*, *Plagiomnium cuspidatum* (toothed plagiomnium moss), *Climacium americanum* (American climacium moss), *Plagiomnium ciliare* (plagiomnium moss), *Leucobryum glaucum* (leucobryum moss), and *Hypnum imponens* (hypnum moss).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association occurs on gorge slopes throughout the length of the Meadow and Gauley rivers in the park. It is more abundant on river left (on the left looking downstream) and in the west end of the park.

Classification Comments: Occurrences of this association at Gauley River tend to have somewhat different composition compared to occurrences at New River and Bluestone, probably reflecting less fertile soils due to the preponderance of acidic sandstones at Gauley River vs. more prevalent shales at New River and Bluestone. Important species in this association at Gauley River which are not as important in the other parks include *Quercus rubra* (northern red oak), *Acer rubrum* (red maple), *Tsuga canadensis* (eastern hemlock), *Rhododendron maximum* (great laurel), *Euonymus americanus* (strawberry bush), and *Dryopteris intermedia* (intermediate woodfern). These species are also important components of Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543) which is the matrix forest at Gauley River. Species less common at Gauley River include *Aesculus flava* (yellow buckeye), *Caulophyllum thalictroides* (blue cohosh), and *Actaea racemosa* var. *racemosa* (black bugbane). The parenthetical nominal *Magnolia tripetala* (umbrella-tree) occurs with low cover in three plots but is not an important species in this association at Gauley River or elsewhere in West Virginia. In West Virginia, the varieties of *Tilia americana* (American basswood) are sympatric and intergrade and are not very useful for circumscribing vegetation types.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Seventeen plots were sampled: GARI.37, GARI.42, GARI.49, GARI.58, GARI.79, GARI.86, GARI.98, GARI.99, GARI.107, GARI.110, GARI.123, GARI.130, GARI.145, GARI.146, GARI.175, GARI.184, and GARI.193.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Liriodendron tulipifera - Tilia americana* var. *heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235)
Alliance (English name)	Tuliptree - Appalachian Basswood - Yellow Buckeye - Sugar Maple Forest Alliance
Association	*Liriodendron tulipifera - Tilia americana* var. *heterophylla - Aesculus flava - Acer saccharum / (Magnolia tripetala)* Forest
Association (English name)	Tuliptree - Appalachian Basswood - Yellow Buckeye - Sugar Maple / (Umbrella-tree) Forest
Ecological System(s):	South-Central Interior Mesophytic Forest (CES202.887).

GLOBAL DESCRIPTION

Concept Summary: This mixed mesophytic forest is found primarily in the Central Appalachians, Western Allegheny Plateau, and Cumberland Plateau ecoregions of the United States. Stands occur on cool, moist slopes and steep ravines or bottoms. The tree canopy is often tall, closed and contains a variety of tree species, including *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree), *Prunus serotina* (black cherry), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak). Trees indicative of the type include *Aesculus flava* (yellow buckeye) and *Tilia americana* var. *heterophylla* (American basswood). *Magnolia acuminata* (cucumber-tree) occurs locally. *Acer rubrum* (red maple) and *Betula lenta* (sweet birch) may be common in areas with a more recent harvest history. Frequent vines and shrubs include *Aristolochia macrophylla* (pipevine), *Asimina triloba* (pawpaw), *Carpinus caroliniana* (American hornbeam), *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush), *Parthenocissus quinquefolia* (Virginia creeper), *Staphylea trifolia* (American bladdernut), *Toxicodendron radicans* (eastern poison ivy), *Vitis aestivalis* var. *bicolor* (summer grape), and more locally *Magnolia tripetala* (umbrella-tree), *Cercis canadensis* (eastern redbud), and *Rhododendron maximum* (great laurel). The herbaceous layer is extremely rich, including *Actaea racemosa* (black bugbane), *Adiantum pedatum* (northern maidenhair), *Arisaema triphyllum* (Jack in the pulpit), *Asarum canadense* (Canadian wildginger), *Botrychium virginianum* (rattlesnake fern), *Caulophyllum thalictroides* (blue cohosh), *Claytonia virginica* (Virginia springbeauty), *Cryptotaenia canadensis* (Canadian honewort), *Dicentra canadensis* (squirrel corn), *Dryopteris marginalis* (marginal woodfern), *Erythronium americanum* (dogtooth violet), *Galium triflorum* (fragrant bedstraw), *Geranium maculatum* (spotted geranium), *Hepatica nobilis* var. *acuta* (sharplobe hepatica), *Hydrophyllum canadense* (bluntleaf waterleaf), *Hydrophyllum virginianum* (Shawnee salad), *Osmorhiza* (sweetroot) spp., *Laportea canadensis* (Canadian woodnettle), *Polystichum acrostichoides* (Christmas fern), *Prosartes lanuginosa* (yellow fairybells), *Sanguinaria canadensis* (bloodroot), *Sedum ternatum* (woodland stonecrop), *Tiarella cordifolia* (heartleaf foamflower), *Trillium erectum* (red trillium), *Trillium grandiflorum* (snow trillium), *Viola canadensis* (Canadian white violet), and many others. Spring ephemeral herbs which bloom before tree leaf-out may be abundant.

Environmental Description: Stands occur on cool, moist slopes and steep ravines or bottoms, often on colluvium. They occur from lower to upper slopes on northerly aspects but are confined to lower slopes and concave positions on more southerly aspects or may be absent on the warmest aspects. They may also occur on alluvial terraces along streams and on abandoned river terraces. Soils are derived from sandstones or shales, sometimes calcareous. Soils in plots from Bluestone National Scenic River, West Virginia, are described as somewhat moist to moist, well-drained sandy loams, silt loams, and clay loams, and tested strongly to slightly acidic (mean pH = 5.5) with relatively high levels of organic matter, estimated N release, B, Ca, K, Mg, Mn, Na, and P, and relatively low levels of S, Al, Cu, and Zn compared to average values in the park.
Vegetation Description: The tree canopy is often tall, closed and contains a variety of tree species, including *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree), *Prunus serotina* (black cherry), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak). Trees indicative of the type include *Aesculus flava* (yellow buckeye) and *Tilia americana* var. *heterophylla* (American basswood). *Magnolia acuminata* (cucumber-tree) occurs locally, and *Tsuga canadensis* (eastern hemlock) and *Carya cordiformis* (bitternut hickory) may also be present. *Acer rubrum* (red maple) and *Betula lenta* (sweet birch) may be common in areas with a more recent harvest history. Frequent vines include *Aristolochia macrophylla* (pipevine), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), and *Vitis aestivalis* var. *bicolor* (summer grape); shrubs include *Asimina triloba* (pawpaw), *Carpinus caroliniana* (American hornbeam), *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush), *Staphylea trifolia* (American bladdernut), and more locally *Magnolia tripetala* (umbrella-tree), *Halesia tetraptera* (mountain silverbell), *Hydrangea arborescens* (wild hydrangea), *Cercis canadensis* (eastern redbud), and *Rhododendron maximum* (great laurel). The herbaceous layer is extremely rich and dominated by shade-tolerant, nutrient-demanding species, including *Actaea racemosa* (black bugbane), *Adiantum pedatum* (northern maidenhair), *Arisaema triphyllum* (Jack in the pulpit), *Asarum canadense* (Canadian wildginger), *Botrychium virginianum* (rattlesnake fern), *Caulophyllum thalictroides* (blue cohosh), *Claytonia virginica* (Virginia springbeauty), *Cryptotaenia canadensis* (Canadian honewort), *Dicentra canadensis* (squirrel corn), *Dryopteris marginalis* (marginal woodfern), *Erythronium americanum* (dogtooth violet), *Galium triflorum* (fragrant bedstraw), *Geranium maculatum* (spotted geranium), *Hepatica nobilis* var. *acuta* (sharplobe hepatica), *Hydrophyllum canadense* (bluntleaf waterleaf), *Hydrophyllum virginianum* (Shawnee salad), *Osmorhiza* (sweetroot) spp., *Laportea canadensis* (Canadian woodnettle), *Polystichum acrostichoides* (Christmas fern), *Prosartes lanuginosa* (yellow fairybells), *Sanguinaria canadensis* (bloodroot), *Sedum ternatum* (woodland stonecrop), *Tiarella cordifolia* (heartleaf foamflower), *Trillium erectum* (red trillium), *Trillium grandiflorum* (snow trillium), *Viola canadensis* (Canadian white violet), and many others. Spring ephemeral herbs which bloom before tree leaf-out may be abundant. Vascular plant richness in West Virginia ranges from 13 to 68 species per 400-square-meter plot. Bryophytes identified in West Virginia include *Thuidium delicatulum* (delicate thuidium moss), *Brachythecium oxycladon* (brachythecium moss), *Brachythecium plumosum* (brachythecium moss), *Anomodon attenuatus* (anomodon moss), *Anomodon rostratus* (anomodon moss), *Loeskeobryum brevirostre* (loeskeobryum moss), *Dicranum fulvum* (dicranum moss), *Dicranodontum denudatum*, *Aulacomnium heterostichum* (aulacomnium moss), *Rhodobryum ontariense*, *Plagiomnium cuspidatum* (toothed plagiomnium moss), *Climacium americanum* (American climacium moss), *Plagiomnium ciliare* (plagiomnium moss), *Hedwigia ciliata* (ciliate

hedwigia moss), *Leucobryum glaucum* (leucobryum moss), and *Hypnum imponens* (hypnum moss).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple) *Liriodendron tulipifera* (tuliptree) *Quercus rubra* (northern red oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush)
Herb (field)	Forb	*Asarum canadense* (Canadian wildginger) *Caulophyllum thalictroides* (blue cohosh) *Hydrophyllum canadense* (bluntleaf waterleaf)

Characteristic Species: *Acer saccharum* (sugar maple), *Actaea racemosa* (black bugbane), *Aesculus flava* (yellow buckeye), *Arisaema triphyllum* (Jack in the pulpit), *Asarum canadense* (Canadian wildginger), *Caulophyllum thalictroides* (blue cohosh), *Hepatica nobilis* var. *acuta* (sharplobe hepatica), *Hydrophyllum canadense* (bluntleaf waterleaf), *Laportea canadensis* (Canadian woodnettle), *Lindera benzoin* (northern spicebush), *Liriodendron tulipifera* (tuliptree), *Magnolia acuminata* (cucumber-tree), *Osmorhiza longistylis* (longstyle sweetroot), *Sedum ternatum* (woodland stonecrop), *Stellaria pubera* (star chickweed), *Tiarella cordifolia* (heartleaf foamflower), *Tilia americana* var. *heterophylla* (American basswood).

Other Noteworthy Species:

Species	GRank	Type	Note
Ailanthus altissima (tree of heaven)	-	plant	invasive exotic
Alliaria petiolata (garlic mustard)	-	plant	invasive exotic

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This type is found primarily in the Central Appalachian, Western Allegheny Plateau, and Cumberland Plateau regions of the United States, ranging from southern Pennsylvania and eastern Ohio south to West Virginia and Tennessee, with outliers in Indiana.

States/Provinces: IN, KY, OH, PA:S1S2, TN, WV.

Federal Lands: NPS (Bluestone, Cumberland Gap, Gauley River, New River Gorge); USFS (Daniel Boone, Monongahela, Wayne).

CONSERVATION STATUS

Rank: G4? (30-Sep-2004).

Reasons: There are still issues with the precise geographic limits of this type and its relationship to similar types in adjacent regions. It represents the typical mesic cove forest of a fairly large area of the central interior eastern United States (from southern Pennsylvania and eastern Ohio south to West Virginia and Tennessee, with outliers in Indiana). Within this range, it only occurs in protected concave topographic positions. Although relatively secure and not highly threatened today, many stands have recovered from past episodes of timber removal and remain threatened by future timber harvests because of excellent site productivity. Much of the remaining acreage which is not formally protected is not of high quality. There are some protected stands on Federal lands (national parks, national forests) in the region. Forests of the region are vulnerable to decline from: (1) aluminum toxicity, related to acidification (from sulfates, exceeding 30 pounds per year per acre); (2) nitrogen deposition, which reduces the capacity of trees on the northern slopes to resist fungal infections; and (3) ozone deposition, which diminishes the photosynthetic capacity of trees, which in turn diminishes their roots. Invasive exotics, especially *Alliaria petiolata* (garlic mustard) (a shade-tolerant herb) and *Ailanthus altissima* (tree of

heaven) (a tree which can become established in canopy gaps, mimicking the niche of *Liriodendron* (tuliptree)), pose a serious threat to the integrity of this community's flora.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Trees indicative of the type include *Aesculus flava* (yellow buckeye) and *Tilia americana* var. *heterophylla* (although the latter intergrades with the nominal variety in some areas, reducing its diagnostic value). In Ohio, however, these are restricted to the more southern parts of Ohio, which, depending on the definition of the type, may restrict its concept. Stands strongly dominated by beech and maple go with the Beech - Maple Unglaciated Forest, *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411); by beech and white oak with the White Oak - Beech Western Allegheny Forest, *Quercus alba - Fagus grandifolia* Western Allegheny Plateau Forest (CEGL006144); and by at least 25% hemlock with the East-Central Hemlock Hardwood Forest, *Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana*, *Kalmia latifolia)* Forest (CEGL005043). In Indiana this type occurs in the southeastern part of the Bluegrass Region, where it is found on calcareous substrates, though further review is needed to determine whether these Indiana stands could be placed in CEGL002411. Mike Homoya of the Indiana Heritage Program has species lists, and stand information should be compiled for review. More information is needed to distinguish these more northern (Central Appalachian) mixed mesophytic forests from similar forests in the Southern Appalachians. Further division may be warranted.

Similar Associations:

- *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411)--lacks *Aesculus flava* (generally out of range), but otherwise many similarities.
- *Fraxinus americana - Carya ovata / Frangula caroliniana / Helianthus hirsutus* Woodland (CEGL008458)--also does not generally have high cover of either *Aesculus flava* or *Tilia americana*, and it tends to be on drier mid- to upper slopes instead of ravine areas.
- *Liriodendron tulipifera - Fraxinus americana - (Tilia americana, Aesculus flava) / Actaea racemosa - Laportea canadensis* Forest (CEGL007710).
- *Liriodendron tulipifera - Tilia americana* var. *heterophylla - (Aesculus flava) / Actaea racemosa* Forest (CEGL007291).
- *Quercus alba - Fagus grandifolia* Western Allegheny Plateau Forest (CEGL006144).
- *Quercus alba - Quercus rubra - Quercus prinus / Collinsonia canadensis - Podophyllum peltatum - Amphicarpaea bracteata* Forest (CEGL007692)--does not have any *Aesculus flava* or *Tilia americana* in it.
- *Quercus prinus - Carya ovata - Quercus rubra / Acer saccharum* Forest (CEGL007268).
- *Tilia americana* var. *heterophylla - Aesculus flava - Acer saccharum / Cystopteris bulbifera - Asarum canadense* Forest (CEGL006472)--is a very rich, bouldery forest of limestone/dolomite coves, gorges and valleys in southwestern Virginia; very similar, lacks some of the characteristic species of CEGL005222 and contains other obligate, low-elevation calciphiles.
- *Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana, Kalmia latifolia)* Forest (CEGL005043)--contains substantial hemlock.

Related Concepts:

- *Acer saccharum - Aesculus flava / Laportea canadensis* forest (Vanderhorst 2001b) =
- IA5d. Typic Mesophytic Forest (Allard 1990) ?
- Mixed Mesophytic Forest (Braun 1950) B
- White Ash - Basswood - Northern Red Oak (Rentch et al. 2005) ?

SOURCES

Description Authors: D. Faber-Langendoen, L. Sneddon, M. Pyne, mod. R. White and S. C. Gawler.

References: Allard 1990, Anderson 1982, Braun 1950, Evans 1991, Fike 1999, Midwestern Ecology Working Group n.d., Rentch et al. 2005, TDNH unpubl. data, Vanderhorst 2001a, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2008, Vanderhorst et al. 2010.

Plot GARI.130. Sugar Maple - Yellow Buckeye - American Basswood Forest.

COMMON NAME (PARK-SPECIFIC): SUCCESSIONAL TULIPTREE FOREST

SYNONYMS
USNVC English Name: **Tuliptree - Oak species Forest**
USNVC Scientific Name: ***Liriodendron tulipifera - Quercus* spp. Forest**
USNVC Identifier: **CEGL007221**

LOCAL INFORMATION

Environmental Description: This association occurs in relatively mesic sites on plateaus, gorge slopes, and floodplains, in areas that were cleared in the past or that have been affected by repeated cycles of logging or other disturbance. It occurs on various aspects, but average solar exposure is relatively low. Slope shape is often concave in one or more directions. Slopes in mapped polygons range from 0.7 to 56 degrees (mean = 21.3). Elevations in mapped polygons range from 210 to 570 m (mean = 414). Unvegetated ground cover in plots is usually dominated by litter, but some plots have significant cover by large rocks. Soils in plots are described as well-drained, dry to moist sand, sandy loam, sandy clay loam, and silt loam. Soils test strongly to very strongly acidic (mean pH = 4.4) with relatively low levels of organic matter and Na compared to average values from all plots in the park. Adjacent vegetation includes Successional Virginia Pine Forest (CEGL002591) in drier positions on abandoned farmland and various natural types in less disturbed areas depending on landform, aspect, and flooding regime.
Vegetation Description: This association represents successional deciduous forests dominated by *Liriodendron tulipifera* (tuliptree). Canopies of mature stands are tall (>20 m) and closed. Common associated trees include (in decreasing order of constancy in plots) *Betula lenta* (sweet birch), *Acer rubrum* (red maple), *Quercus rubra* (northern red oak), *Oxydendrum arboreum* (sourwood), *Acer saccharum* var. *saccharum* (sugar maple), *Magnolia tripetala* (umbrella-tree), *Liquidambar styraciflua* (sweetgum), *Populus grandidentata* (bigtooth aspen), and *Sassafras albidum* (sassafras). The vines *Vitis aestivalis* (summer grape) and *Parthenocissus quinquefolia* (Virginia creeper) commonly reach the subcanopy. The conifer *Tsuga canadensis* (eastern hemlock) is abundant in the understories of many stands, indicating successional direction towards this shade-tolerant climax species. The evergreen shrubs *Rhododendron maximum* (great laurel) and *Ilex opaca* var. *opaca* (American holly) may have high cover. Additional common shrubs in plots include *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), *Amelanchier arborea* var. *arborea* (common serviceberry), *Hamamelis virginiana* (American witchhazel), and *Lindera benzoin* (northern spicebush). There is usually moderate to high cover in the herb layer, which is usually dominated by species adapted to relatively mesic conditions. Herbs with high constancy or cover in plots include *Polystichum acrostichoides* (Christmas fern), *Dryopteris intermedia* (intermediate woodfern), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), *Packera aurea* (golden ragwort), *Amphicarpaea bracteata* (American hogpeanut), *Thelypteris noveboracensis* (New York fern), *Lycopodium digitatum* (fan clubmoss), *Duchesnea indica* (Indian strawberry), and *Meehania cordata* (Meehan's mint). Vascular plant species richness in 400-square-meter plots ranges from 17 to 79 taxa (mean = 39.4).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNA	.	.	[not crosswalked]	.

Local Range: Information not available.

Classification Comments: This association represents all successional stands dominated by *Liriodendron tulipifera* (tuliptree) at Gauley River. These include upland stands that are clearly succeeding towards hemlock dominance, as well as stands on disturbed upper floodplains that grade towards American Sycamore - Tuliptree - Sweetgum Floodplain Forest (CEGL004418). Most stands do not have a significant oak component, but they are placed in CEGL007221 rather than creating additional successional tuliptree associations. Most sites supporting this type at Gauley River are probably more mesic than typical for CEGL007221 but lack the higher soil pH and fertility represented by CEGL007220.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Eight plots were sampled: GARI.33, GARI.62, GARI.63, GARI.72, GARI.126, GARI.141, GARI.172, and GARI.179.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Liriodendron tulipifera* Forest Alliance (A.236)
Alliance (English name)	Tuliptree Forest Alliance
Association	*Liriodendron tulipifera - Quercus* spp. Forest
Association (English name)	Tuliptree - Oak species Forest
Ecological System(s):	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898). Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074).

GLOBAL DESCRIPTION

Concept Summary: This broadly defined semi-natural or successional community is one of several described upland associations dominated by *Liriodendron tulipifera* (tuliptree). It ranges from the southern Cumberland Plateau, Piedmont, and Interior Low Plateau of the southeastern U.S. north to the northern Piedmont of New Jersey. These successional forests often follow cropping, clearcut logging, or other severe disturbance, and are successional to mixed oak-hickory forests. Examples are common across large areas of the upland landscape which have previously been disturbed. Soils usually exhibit evidence of disturbance and may have little to no organic horizon development. They are typically acidic and well-drained, dry to moist sand, sandy loam, sandy clay loam, or silt loam. Environmental setting is variable, ranging from level to gently sloping uplands to well-drained floodplains and stream terraces. Species found in stands attributable to this type may include a fairly diverse and varied composition. *Acer rubrum* (red maple), *Quercus* (oak) spp., *Betula lenta* (sweet birch), *Oxydendrum arboreum* (sourwood), *Acer saccharum* (sugar maple), and occasionally *Liquidambar styraciflua* (sweetgum), *Ilex opaca* (American holly), or *Robinia pseudoacacia* (black locust) may be common in stands of this type. Where oaks are present, they are frequently multi-stemmed, resulting from coppicing.

The conifer *Tsuga canadensis* (eastern hemlock) is abundant in the understories of some stands. Shrub composition is variable but may include *Sambucus canadensis* (common elderberry), *Rhododendron maximum* (great laurel), *Hamamelis virginiana* (American witchhazel), and *Vaccinium pallidum* (Blue Ridge blueberry). Herbs are likewise variable; West Virginia samples feature *Dioscorea quaternata* (fourleaf yam), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Maianthemum racemosum* (feathery false lily of the valley), *Solidago curtisii*, *Symphyotrichum prenanthoides* (crookedstem aster), *Polystichum acrostichoides* (Christmas fern), *Dryopteris intermedia* (intermediate woodfern), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), *Packera aurea* (golden ragwort), *Amphicarpaea bracteata* (American hogpeanut), *Thelypteris noveboracensis* (New York fern), *Lycopodium digitatum* (fan clubmoss), and *Geranium maculatum* (spotted geranium).

Environmental Description: These semi-natural upland deciduous forests are found primarily in areas which were once clearcuts, old fields, or were cleared by fire or other natural disturbances. These successional forests often follow cropping, clearcut logging, or other severe disturbance, and are successional to mixed oak-hickory forests. Examples are common across large areas of the upland landscape which have previously been disturbed. Soils usually exhibit evidence of disturbance and may have little to no organic horizon development. Environmental setting is variable, ranging from level to gently sloping uplands to well-drained floodplains and stream terraces.

Vegetation Description: The canopy of this semi-natural upland association is dominated by *Liriodendron tulipifera* (tuliptree). *Quercus* (oak) species (*Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus falcata* (southern red oak), *Quercus nigra* (water oak), *Quercus velutina* (black oak)) are often present; additional associates may include *Acer barbatum* (southern sugar maple), *Acer rubrum* (red maple), *Carya* (hickory) spp., *Fagus grandifolia* (American beech), *Nyssa sylvatica* (blackgum), *Cornus florida* (flowering dogwood), and *Robinia pseudoacacia* (black locust). *Betula lenta* (sweet birch) is a common associate at the northern range limit. Shrub layers may include saplings of the canopy species and *Acer pensylvanicum* (striped maple), *Amelanchier arborea* (common serviceberry), *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush) (in small amounts), and *Vaccinium pallidum* (Blue Ridge blueberry). Herbs vary across the range but may include *Actaea racemosa* (black bugbane), *Dichanthelium clandestinum* (deertongue), *Dioscorea quaternata* (fourleaf yam), *Galium circaezans* (licorice bedstraw), *Geranium maculatum* (spotted geranium), *Goodyera pubescens* (downy rattlesnake plantain), *Medeola virginiana* (Indian cucumber), *Potentilla simplex* (common cinquefoil), *Scutellaria serrata* (showy skullcap), *Thelypteris noveboracensis* (New York fern), and *Uvularia perfoliata* (perfoliate bellwort). *Lycopodium digitatum* (fan clubmoss) may be abundant in some stands.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Liriodendron tulipifera* (tuliptree)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Cornus florida* (flowering dogwood)
Herb (field)	Fern or fern ally	*Lycopodium digitatum* (fan clubmoss)

Characteristic Species: *Acer pensylvanicum* (striped maple), *Acer rubrum* (red maple), *Actaea racemosa* (black bugbane), *Amelanchier arborea* (common serviceberry), *Carya glabra* (pignut hickory), *Dichanthelium clandestinum* (deertongue), *Fagus grandifolia* (American beech), *Galium circaezans* (licorice bedstraw), *Geranium maculatum* (spotted geranium), *Goodyera pubescens* (downy rattlesnake plantain), *Hamamelis virginiana* (American witchhazel), *Lycopodium digitatum* (fan clubmoss), *Medeola virginiana* (Indian cucumber), *Nyssa sylvatica*

(blackgum), *Quercus falcata* (southern red oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Robinia pseudoacacia* (black locust), *Thelypteris noveboracensis* (New York fern), *Uvularia perfoliata* (perfoliate bellwort), *Vaccinium pallidum* (Blue Ridge blueberry).

Other Noteworthy Species:

Species	GRank	Type	Note
Hexastylis naniflora (dwarfflower heartleaf)	G3	plant	Federally listed threatened
Trillium rugelii (illscented wakerobin)	G3	plant	
Trillium simile (jeweled wakerobin)	G3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association is known from the southern Cumberland Plateau, Piedmont, and Interior Low Plateau of the southeastern U.S. and may also occur in the Upper East Gulf Coastal Plain. It ranges north to the northern Piedmont of New Jersey and adjacent Pennsylvania. It is also known from Alabama, Georgia, Kentucky, Maryland, North Carolina, South Carolina, Tennessee, West Virginia, and possibly Virginia and Delaware.

States/Provinces: AL, DC?, DE?, GA, KY, MD, NC, NJ, PA, SC, TN, VA, WV.

Federal Lands: BIA (Eastern Band of Cherokee); DOD (Fort Benning); NPS (Appomattox Court House, Big South Fork, Blue Ridge Parkway, Booker T. Washington, C&O Canal, Catoctin Mountain?, Chattahoochee River, Chickamauga-Chattanooga?, Cowpens, Cumberland Gap, Fredericksburg-Spotsylvania, Gauley River, George Washington Parkway, Guilford Courthouse, Horseshoe Bend, Kennesaw Mountain, Kings Mountain, Mammoth Cave, Monocacy?, Morristown, Natchez Trace, National Capital-East?, New River Gorge, Ninety Six, Obed, Petersburg, Prince William, Richmond, Shiloh, Valley Forge, Wolf Trap); USFS (Bankhead, Daniel Boone, Oconee?, Talladega, Talladega (Oakmulgee)?, Talladega (Talladega)).

CONSERVATION STATUS

Rank: GNA (ruderal) (19-Aug-2002).

Reasons: This forest represents early-successional vegetation and is thus not a priority for conservation. This is a successional vegetation type composed of native species. Its conservation value is limited, but mature examples could provide buffer for communities of greater conservation value. It may also support rare animal and plant species.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: It differs from other described types within its range based on the lack of a significant pine component [see *Liriodendron tulipifera - Pinus taeda* Forest (CEGL007521)] and the absence of species affiliated with circumneutral conditions [see *Liriodendron tulipifera / (Cercis canadensis) / (Lindera benzoin)* Forest (CEGL007220)]; it is later successional and more diverse than *Liriodendron tulipifera* Forest (CEGL007218) and tends to be found on more stable soil substrates and less steep slopes than *Liriodendron tulipifera - Acer rubrum - Robinia pseudoacacia* Forest (CEGL007219).

Similar Associations:

- *Liriodendron tulipifera - Acer negundo* Forest (CEGL007184)--a bottomland type.
- *Liriodendron tulipifera - Acer rubrum - Robinia pseudoacacia* Forest (CEGL007219)--is generally found on steeper slopes and/or shallow soils and with a more intense history of disturbance.
- *Liriodendron tulipifera / (Cercis canadensis) / (Lindera benzoin)* Forest (CEGL007220)--is generally found on calcareous or at least pH neutral soils.
- *Liriodendron tulipifera* Forest (CEGL007218)--more early-successional.
- *Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana - (Robinia pseudoacacia)* Forest (CEGL006599).
- *Prunus serotina - Sassafras albidum - (Fraxinus americana) / Juniperus virginiana* Forest (CEGL004133).

Related Concepts:

- Successional forest of low-elevation plateaus (Vanderhorst 2001a) B
- Tulip Poplar Type (Schmalzer and DeSelm 1982) B
- Yellow Poplar community (Ehrenfeld 1977) =

SOURCES

Description Authors: R. E. Evans and M. Pyne, mod. L. A. Sneddon, R. White, S .C. Gawler.
References: Ehrenfeld 1977, Gallyoun et al. 1996, Keever 1973, NatureServe Ecology - Southeastern U.S. unpubl. data, Overlease 1987, Russell and Schuyler 1988, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001a, Vanderhorst and Streets 2006, Vanderhorst et al. 2010.

Plot GARI.172. Successional Tuliptree Forest.

COMMON NAME (PARK-SPECIFIC): OAK / ERICAD FOREST

SYNONYMS

USNVC English Name: **(Chestnut Oak, Scarlet Oak) / Mountain Laurel / (Beetleweed, Wintergreen) Forest**

USNVC Scientific Name: ***Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest**

USNVC Identifier: **CEGL006271**

LOCAL INFORMATION

Environmental Description: This association occurs in small to medium-sized patches in warm, dry topographic positions of gorge slopes. Most occurrences are on steep upper slopes with southerly aspects. Average solar exposure is very high. Slopes in mapped polygons range from 2 to 46 degrees (mean = 25.5). Elevations in mapped polygons range from 224 to 603 m (mean = 365.2). Bedrock geology is predominantly sandstones of the New River and Kanawha formations in the Pottsville group. Unvegetated ground cover in plots is dominated by litter and large rocks. Soils in plots are described as well- to rapidly-drained, dry to very dry sandy loam, sandy clay loam, and clay loam. Soils test strongly to extremely acidic (mean pH = 4.44) with relatively high levels of estimated N release and relatively low levels of organic matter, Ca, Cu, Mg, Mn, Na, P and Zn compared to average values from all plots in the park. Adjacent vegetation often includes Cliff Top Virginia Pine Forest (CEGL007110) in more xeric positions and Oak - Hickory Forest (CEGL007267) and Oak / Great Laurel Forest (CEGL006286) in more mesic positions.

Vegetation Description: This association is a mostly deciduous forest dominated by oaks over a shrub layer dominated by species in the Ericaceae (heath family) adapted to xeric site conditions. Canopies are tall (>20 m) or somewhat stunted (10–20 m) and tend to be somewhat more open compared to other deciduous forests in the park. Dominant canopy trees in plots include (in decreasing order of constancy) *Quercus velutina* (black oak), *Quercus prinus* (chestnut oak), *Quercus coccinea* var. *coccinea* (scarlet oak), and *Quercus alba* (white oak). Important canopy trees with lower cover and constancy in plots include *Acer rubrum* (red maple), *Carya alba* (mockernut hickory), *Pinus rigida* (pitch pine), *Tsuga canadensis* (eastern hemlock), *Betula lenta* (sweet birch), *Quercus rubra* (northern red oak), and *Carya glabra* (pignut hickory). *Acer rubrum* (red maple) and *Oxydendrum arboreum* (sourwood) are often abundant in the subcanopy. The evergreen shrub *Kalmia latifolia* (mountain laurel) is constant in plots and typically dominates the shrub layers. Additional common shrubs include *Smilax glauca* (cat greenbrier), *Sassafras albidum* (sassafras), *Vaccinium pallidum* (Blue Ridge blueberry), *Smilax rotundifolia* (roundleaf greenbrier), *Amelanchier arborea* var. *arborea* (common serviceberry), *Hamamelis virginiana* (American witchhazel), *Ilex opaca* var. *opaca* (American holly), *Viburnum acerifolium* (mapleleaf viburnum), and *Gaylussacia baccata* (black huckleberry). The subshrub *Gaultheria procumbens* (eastern teaberry) has high constancy. Herb cover is usually sparse. Characteristic herbs include *Solidago caesia* (wreath goldenrod), *Coreopsis major* (greater tickseed), *Carex digitalis* var. *digitalis* (slender woodland sedge), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Hieracium venosum* (rattlesnakeweed), *Dichanthelium dichotomum* var. *dichotomum* (cypress panicgrass), *Danthonia spicata* (poverty oatgrass), and *Chimaphila maculata* (striped prince's pine). Vascular plant species richness in 400-square-meter plots ranges from 22 to 60 taxa (mean = 32.8). Common mosses include

Leucobryum glaucum (leucobryum moss), *Thuidium delicatulum* (delicate thuidium moss), and *Dicranum fulvum* (dicranum moss). Common lichens include *Umbilicaria mammulata* (navel lichen), *Flavoparmelia baltimorensis*, and *Cladonia furcata* (cup lichen).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	.	.	[not crosswalked]	.

Local Range: This association occurs in small patches scattered on upper gorge slopes above the Gauley and Meadow rivers throughout their lengths in the park. It is more abundant on river right (on the right looking downstream) and above the lower Gauley at the west end of the park.
Classification Comments: Some examples of this association at Gauley River grade toward Oak - Hickory Forest (CEGL007267); abundance of *Kalmia latifolia* (mountain laurel) is the best indicator to distinguish these types. Oak forests in somewhat less xeric sites with shrub layers dominated by *Rhododendron maximum* (great laurel) are classified as Oak / Great Laurel Forest (CEGL006286).
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Ten plots were sampled: GARI.35, GARI.54, GARI.77, GARI.104, GARI.116, GARI.134, GARI.135, GARI.138, GARI.163, and GARI.191.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus prinus - (Quercus coccinea, Quercus velutina)* Forest Alliance (A.248)
Alliance (English name)	Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance
Association	*Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest
Association (English name)	(Chestnut Oak, Scarlet Oak) / Mountain Laurel / (Beetleweed, Wintergreen) Forest
Ecological System(s):	Southern Appalachian Oak Forest (CES202.886).

GLOBAL DESCRIPTION

Concept Summary: This community includes xeric ridgetop and exposed slope forests in the Southern Blue Ridge, ranging south and east into the upper Piedmont, north into the Central Appalachians, and north and west into the Ridge and Valley. This community occurs over shallow soils, primarily on south- to west-facing slopes and ridgetops where solar exposure is high. Soils are rocky, infertile, dry, acidic sandy loams typically derived from sandstone. The community includes forests with canopies strongly dominated by *Quercus prinus* (chestnut oak) and/or *Quercus coccinea* (scarlet oak), with lesser amounts of *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), *Quercus falcata* (southern red oak), *Oxydendrum arboreum* (sourwood), *Nyssa sylvatica* (blackgum), *Pinus virginiana* (Virginia pine), and *Acer rubrum* (red maple), occurring over a typically dense shrub stratum dominated by ericaceous species. The

shrub layer may vary between evergreen and deciduous dominance. Typical shrub species include *Kalmia latifolia* (mountain laurel), *Rhododendron maximum* (great laurel), *Vaccinium stamineum* (deerberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Gaylussacia ursina* (bear huckleberry), *Gaylussacia baccata* (black huckleberry), and (in the more southern portions of the range) *Leucothoe recurva* (redtwig doghobble). *Castanea dentata* (American chestnut) may occur abundantly as root sprouts. The herb layer is typically sparse and includes subshrubs such as *Epigaea repens* (trailing arbutus) and *Gaultheria procumbens* (eastern teaberry). Other common species include *Chamaelirium luteum* (fairywand), *Chimaphila maculata* (striped prince's pine), *Galax urceolata* (beetleweed), *Magnolia fraseri* (mountain magnolia), *Sassafras albidum* (sassafras), *Symplocos tinctoria* (common sweetleaf), *Smilax rotundifolia* (roundleaf greenbrier), and *Smilax glauca* (cat greenbrier). This community is distinguished by its overall floristic composition, with a high abundance of acid-loving ericaceous species, which are indicative of this community's extremely infertile, acidic soils.
Environmental Description: This community occurs on upper slopes, ridges and spurs, usually convex, primarily on south- to west-facing slopes and ridgetops where solar exposure is high. This community includes xeric ridgetop forests in the Southern Blue Ridge, ranging south and east into the upper Piedmont and north into the Central Appalachians, and west into the Ridge and Valley. Soils are rocky, infertile, dry to very dry, acidic sandy loams to clay loams often derived from sandstone. These forests occur on moderate to very steep slopes or on flat to gently sloping interfluves. Sites supporting this association are typically below 1067 m elevation (3500 ft), but range up to 1280 m (4200 ft). The average elevation of 55 plots classified as this association in the Appalachian Trail project (Fleming and Patterson 2009a) is 845 m (2771 ft), ranging from 262 m (860 ft) to 1305 m (4281 ft).
Vegetation Description: Stands of this association are forests with canopies strongly dominated by *Quercus prinus* (chestnut oak) and *Quercus coccinea* (scarlet oak) alone or in mixture. *Quercus velutina* (black oak) is an important associate in some stands. Other trees, usually in lesser amounts, include *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Oxydendrum arboreum* (sourwood), *Nyssa sylvatica* (blackgum), *Pinus virginiana* (Virginia pine), *Pinus rigida* (pitch pine), *Betula lenta* (sweet birch), and *Acer rubrum* (red maple). *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Magnolia acuminata* (cucumber-tree), and *Magnolia fraseri* (mountain magnolia) are present in some areas. The trees grow over a typically dense shrub stratum dominated by ericaceous species, which may display either evergreen or deciduous dominance. Typical shrub species include *Kalmia latifolia* (mountain laurel), *Vaccinium stamineum* (deerberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Gaylussacia ursina* (bear huckleberry), and *Gaylussacia baccata* (black huckleberry). Some areas may feature *Rhododendron maximum* (great laurel), *Rhododendron calendulaceum* (flame azalea), *Rhododendron catawbiense* (Catawba rosebay), and *Leucothoe recurva* (redtwig doghobble). *Castanea dentata* (American chestnut) may occur abundantly as root sprouts. The herb layer is typically sparse and includes subshrubs such as *Epigaea repens* (trailing arbutus) and *Gaultheria procumbens* (eastern teaberry). Other common species include *Carex digitalis* var. *digitalis* (slender woodland sedge), *Chamaelirium luteum* (fairywand), *Chimaphila maculata* (striped prince's pine), *Coreopsis major* (greater tickseed), *Galax urceolata* (beetleweed), *Danthonia spicata* (poverty oatgrass), *Dichanthelium dichotomum* var. *dichotomum* (cypress panicgrass), *Dioscorea quaternata* (fourleaf yam), *Hieracium venosum* (rattlesnakeweed), *Houstonia longifolia* (longleaf summer bluet), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Solidago caesia* (wreath goldenrod), *Symplocos tinctoria* (common

sweetleaf), and *Potentilla simplex* (common cinquefoil). Mosses include *Dicranum fulvum* (dicranum moss), *Dicranum scoparium* (dicranum moss), *Thuidium delicatulum* (delicate thuidium moss), and *Leucobryum glaucum* (leucobryum moss). Macrolichens include *Flavoparmelia baltimorensis*, *Cladonia furcata* (cup lichen), *Lasallia* (blistered navel lichen) *papulosa* and *Umbilicaria mammulata* (navel lichen). This community is distinguished by its overall floristic composition, with a high abundance of acid-loving ericaceous species, which are indicative of this community's extremely infertile, acid soils. In the Great Smoky Mountains *Acer rubrum* (red maple) is often dominant or codominant in these forests, presumably on former American chestnut (*Castanea dentata)* sites. In the Blue Ridge-Piedmont transition, below 853 m (2800 ft) elevation, where this community is often associated with *Pinus rigida* (pitch pine) forests and woodlands, *Quercus falcata* (southern red oak) may be a component of the canopy, and the shrub stratum is strongly dominated by *Vaccinium pallidum* (Blue Ridge blueberry).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus alba* (white oak)
		Quercus coccinea (scarlet oak)
		Quercus prinus (chestnut oak)
		Quercus velutina (black oak)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium stamineum* (deerberry)
Tall shrub/sapling	Broad-leaved evergreen shrub	*Kalmia latifolia* (mountain laurel)
Herb (field)	Dwarf-shrub	*Epigaea repens* (trailing arbutus)
		Galax urceolata (beetleweed)
		Gaultheria procumbens (eastern teaberry)

Characteristic Species: *Acer rubrum* (red maple), *Carex digitalis* var. *digitalis* (slender woodland sedge), *Castanea dentata* (American chestnut), *Chimaphila maculata* (striped prince's pine), *Coreopsis major* (greater tickseed), *Danthonia spicata* (poverty oatgrass), *Dichanthelium dichotomum* var. *dichotomum* (cypress panicgrass), *Galax urceolata* (beetleweed), *Gaylussacia baccata* (black huckleberry), *Hieracium venosum* (rattlesnakeweed), *Kalmia latifolia* (mountain laurel), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Nyssa sylvatica* (blackgum), *Oxydendrum arboreum* (sourwood), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus prinus* (chestnut oak), *Quercus velutina* (black oak), *Rhododendron periclymenoides* (pink azalea), *Sassafras albidum* (sassafras), *Solidago caesia* (wreath goldenrod), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry).

Other Noteworthy Species:

Species	GRank	Type	Note
Canoparmelia amabilis (worthy shield lichen)	G1	plant	globally critically imperiled
Hexastylis contracta (mountain heartleaf)	G3	plant	
Monotropsis odorata (pygmypipes)	G3	plant	
Robinia hispida var. *rosea* (bristly locust)	G4T3?	plant	
Smilax biltmoreana (Biltmore's carrionflower)	-	plant	
Thermopsis fraxinifolia (ashleaf goldenbanner)	G3?	plant	
Thermopsis mollis (Allegheny Mountain goldenbanner)	G3G4	plant	
Vaccinium hirsutum (hairy blueberry)	G3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: The center of distribution for this community is the Southern Blue Ridge of southwestern Virginia, western North Carolina, eastern Tennessee, northeastern Georgia, and northwestern South Carolina. It ranges south and east into the upper Piedmont and north into the

Central Appalachians. This type is common in the Southern Ridge and Valley and Cumberland Mountains of southwestern Virginia and presumably Kentucky.
States/Provinces: GA, KY, NC, SC, TN, VA:S4S5, WV.
Federal Lands: BIA (Eastern Band of Cherokee); NPS (Appalachian Trail, Blue Ridge Parkway, Carl Sandburg Home, Cumberland Gap, Gauley River, Great Smoky Mountains, New River Gorge); USFS (Chattahoochee, Chattahoochee (Piedmont)?, Chattahoochee (Southern Blue Ridge), Cherokee, Daniel Boone, Jefferson, Nantahala, Pisgah, Sumter, Sumter (Mountains), Sumter (Piedmont)?).

CONSERVATION STATUS
Rank: G5 (31-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 1 - Strong.
Comments: A similar association defined for the southern Cumberland Plateau, *Quercus prinus - (Quercus coccinea) / Carya pallida / Vaccinium arboreum - Vaccinium pallidum* Forest (CEGL008431), occurs over sandstone or other geologies not as acidic as the Blue Ridge type and lacks species indicative of the Blue Ridge association, such as *Kalmia latifolia* (mountain laurel), *Gaylussacia ursina* (bear huckleberry), *Gaylussacia baccata* (black huckleberry), and *Gaultheria procumbens* (eastern teaberry).

In the Great Smoky Mountains, *Acer rubrum* (red maple) is often dominant or codominant in these forests, presumably on former American chestnut (*Castanea dentata)* sites. In the Blue Ridge-Piedmont transition, below 853 m (2800 ft) elevation, where this community is often associated with *Pinus rigida* (pitch pine) forests and woodlands, *Quercus falcata* (southern red oak) may be a component of the canopy, and the shrub stratum is strongly dominated by *Vaccinium pallidum* (Blue Ridge blueberry). A similar association defined for the southern Cumberland Plateau, *Quercus prinus - (Quercus coccinea) / Carya pallida / Vaccinium arboreum - Vaccinium pallidum* Forest (CEGL008431), occurs over sandstone or other geologies not as acid as the Blue Ridge type and lacks species indicative of the Blue Ridge association, such as *Kalmia latifolia* (mountain laurel), *Gaylussacia ursina* (bear huckleberry), *Gaylussacia baccata* (black huckleberry), and *Gaultheria procumbens* (eastern teaberry).

In 55 plots classified as this association (homoteneity = 0.60) in the Appalachian Trail analysis (Fleming and Patterson 2009a), the most constant species, in order of descending constancy are *Acer rubrum* (red maple), *Kalmia latifolia* (mountain laurel), *Quercus prinus* (chestnut oak), *Quercus coccinea* (scarlet oak), *Nyssa sylvatica* (blackgum), *Vaccinium pallidum* (Blue Ridge blueberry), *Oxydendrum arboreum* (sourwood), *Galax urceolata* (beetleweed), *Smilax rotundifolia* (roundleaf greenbrier), *Castanea dentata* (American chestnut), *Sassafras albidum* (sassafras), and *Smilax glauca* (cat greenbrier). Species richness ranges from 13–52 species and averages 30 species per 400-m^2 plot sample. In this same analysis, a group of 11 plots from the Great Smoky and Nantahala mountains segregated as a distinct group in cluster analysis. While the composition of this group fits within the broad concept of this association (CEGL006271), this "southern variant" is distinguished by the dominance of *Gaylussacia ursina* (bear huckleberry) and the greater importance of *Quercus rubra* (northern red oak), *Pyrularia pubera* (buffalo nut), *Tsuga canadensis* (eastern hemlock), and *Magnolia fraseri* (mountain magnolia)

than in the "typic" expression of CEGL006271. Further, species that are common in the "typic" expression of CEGL006271, *Quercus coccinea* (scarlet oak), *Nyssa sylvatica* (blackgum), *Vaccinium pallidum* (Blue Ridge blueberry), *Gaylussacia baccata* (black huckleberry), and *Leucothoe recurva* (redtwig doghobble), are absent or inconstant in the "southern variant." Based on available plot data, environmental and geographic distinctions could not be made between the two groups, but further study may be warranted.

Similar Associations:

- *Acer rubrum* var. *rubrum - Betula (alleghaniensis, lenta) - Magnolia fraseri / (Rhododendron maximum, Kalmia latifolia)* Forest (CEGL008558)--is an acidic mixed hardwood forest of the Southern Blue Ridge, resulting after severe fire, logging, or loss of chestnut; a modified type originally defined from the Great Smoky Mountains.
- *Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum* Forest (CEGL007119).
- *Quercus alba - Quercus (coccinea, velutina, prinus) / Gaylussacia baccata* Forest (CEGL008521).
- *Quercus prinus - (Quercus coccinea) / Carya pallida / Vaccinium arboreum - Vaccinium pallidum* Forest (CEGL008431)--defined for the southern Cumberland Plateau and western fringe of the southern Blue Ridge, with more diverse shrubs.
- *Quercus prinus - (Quercus coccinea, Quercus rubra) / Kalmia latifolia / Vaccinium pallidum* Forest (CEGL006299)--is the Central Appalachian analogue of CEGL006271; compositionally similar but generally lacking Southern Appalachian species such as *Galax*, *Oxydendrum*, and *Leucothoe recurva*.
- *Quercus prinus - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (CEGL007267).
- *Quercus prinus - Carya* spp. - *Quercus velutina / Vaccinium arboreum / Iris verna* var. *smalliana* Forest (CEGL007261)--is defined for the lower Piedmont of Alabama and has Coastal Plain affinities.
- *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023)--is a broadly defined type for the Appalachian Plateau and Interior Low Plateau.
- *Quercus prinus - Quercus (rubra, velutina) / Vaccinium angustifolium* Forest (CEGL006282)--is defined for the Northern Piedmont, Central Appalachians; occurs on granite monadnocks.
- *Quercus prinus - Quercus alba / Oxydendrum arboreum / Vitis rotundifolia* Forest (CEGL006281).
- *Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest (CEGL006286)--is more mesic and has a higher component of *Rhododendron maximum* and relatively little *Kalmia latifolia*.

Related Concepts:

- *Quercus alba - Quercus velutina - (Quercus prinus) / Vaccinium pallidum - (Kalmia latifolia)* forest (Vanderhorst 2001b) =
- *Quercus montana - Quercus coccinea / Vaccinium pallidum* Forest (Fleming and Moorhead 2000) ?
- *Quercus montana / Kalmia latifolia / Vaccinium pallidum* Association, *pro parte* (Rawinski et al. 1996) ?
- *Quercus prinus - Quercus coccinea / Kalmia latifolia / Vaccinium pallidum* Forest (Fleming and Coulling 2001) =
- Chestnut Oak Forest (Dry Heath Subtype) (Schafale 1998b) ?
- Chestnut Oak Forests (McLeod 1988) ?
- Chestnut Oak type (Golden 1974) ?
- Chestnut Oak, BR, CUPL (Pyne 1994) ?
- Chestnut Oak-Chestnut Heath (Whittaker 1956) ?
- Chestnut Oak: 44 (Eyre 1980) B
- Chestnut oak-scarlet oak/ericad forest: (matrix) xeric, S- & SW-facing slopes (CAP pers. comm. 1998) ?
- IA6d. Chestnut Oak Slope and Ridge Forest (Allard 1990) B
- Oak / Heath Forest (Fleming and Coulling 2001) B

SOURCES

Description Authors: K. D. Patterson, mod. R. White and S. C. Gawler.

References: Allard 1990, CAP pers. comm. 1998, Evans 1991, Eyre 1980, Fleming and Coulling 2001, Fleming and Moorhead 2000, Fleming and Patterson 2009a, Fleming et al. 2001, Golden 1974, Major et al. 1999, McLeod 1988, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Peet et al. unpubl. data 2002, Pyne 1994, Rawinski et al. 1996, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., TDNH

unpubl. data, VDNH 2003, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2010, Whittaker 1956.

Plot GARI.116. Oak / Ericad Forest.

COMMON NAME (PARK-SPECIFIC): EASTERN HEMLOCK - CHESTNUT OAK / CATAWBA ROSEBAY FOREST

SYNONYMS
USNVC English Name: **Chestnut Oak / Catawba Rosebay - Mountain Laurel Forest**
USNVC Scientific Name: ***Quercus prinus / Rhododendron catawbiense - Kalmia latifolia* Forest**
USNVC Identifier: **CEGL008524**

LOCAL INFORMATION

Environmental Description: This association occurs in a few small patches on rocky plateau rims, upper gorge slopes, and ridge spurs. Sites have variable aspects, and individual stands may span slope and aspect gradients associated with a ridge or outcrop, but mean solar exposure in mapped polygons is very high. Slopes in mapped polygons range from 10 to 40 degrees (mean = 28.3). Elevations in mapped polygons range from 327 to 567 m (mean = 472.3). Bedrock geology is mapped as primarily sandstones of the New River formation in the Pottsville group. Unvegetated ground cover in plots is dominated by litter, and significant bedrock is exposed in one plot. Soils in plots are described as well- to rapidly-drained, dry sandy loam and silty clay. Soils test very strongly to extremely acidic (mean pH = 4.08) with relatively high levels of total exchange capacity, estimated N release, S, Al, and Fe, and relatively low levels of Ca, Cu, Mg, Mn, P, and Zn compared to average values from all plots in the park. Adjacent communities include small patches of Cliff Top Virginia Pine Forest (CEGL007119), Oak - Hickory Forest (CEGL007267), Oak / Great Laurel Forest (CEGL006286), and Oak / Ericad Forest (CEGL006271) all imbedded in the matrix Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543).
Vegetation Description: This association represents forests with deciduous or mixed evergreen-deciduous canopies over an evergreen shrub layer. Canopy trees are often somewhat stunted (<20 m). Codominant trees in plots include *Quercus prinus* (chestnut oak), *Tsuga canadensis* (eastern hemlock), *Quercus velutina* (black oak), *Quercus coccinea* var. *coccinea* (scarlet oak), *Quercus alba* (white oak), and *Pinus virginiana* (Virginia pine). Additional trees that are abundant in the subcanopy include *Acer rubrum* (red maple) and *Oxydendrum arboreum* (sourwood). There is usually a dense tall-shrub layer codominated by *Rhododendron catawbiense* (Catawba rosebay) and *Rhododendron maximum* (great laurel). Additional common shrubs include *Hamamelis virginiana* (American witchhazel), *Smilax rotundifolia* (roundleaf greenbrier), *Ilex opaca* var. *opaca* (American holly), and *Kalmia latifolia* (mountain laurel). The herb layer has low cover and diversity dominated by evergreen species. The subshrub *Gaultheria procumbens* (eastern teaberry) has high constancy. Characteristic herbs (including subshrubs) that occur in fewer plots include *Polypodium virginianum* (rock polypody), *Chimaphila maculata* (striped prince's pine), *Dryopteris intermedia* (intermediate woodfern), *Cypripedium acaule* (moccasin flower), *Epigaea repens* (trailing arbutus), *Conopholis americana* (American squawroot), *Goodyera pubescens* (downy rattlesnake plantain), *Hexastylis virginica* (Virginia heartleaf), and *Mitchella repens* (partridgeberry). Vascular plant species richness in plots ranges from 13 to 28 (mean = 21.5). Nonvascular cover is low. Bryophytes identified in plots include *Leucobryum glaucum* (leucobryum moss), *Hypnum imponens* (hypnum moss), *Thuidium delicatulum* (delicate thuidium moss), *Dicranum scoparium* (dicranum moss), *Bazzania trilobata*

(common bazzania liverwort), and *Polytrichum juniperinum* (juniper polytrichum moss). Lichens in plots include *Umbilicaria mammulata* (navel lichen) and *Cladonia uncialis* (cup lichen).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	S2	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association occurs in a few scattered patches on gorge slopes above the middle Gauley and the Meadow rivers in the park.
Classification Comments: Occurrences of this association at Gauley River are very small and grade towards adjacent types including Cliff Top Virginia Pine Forest (CEGL007119), Oak / Great Laurel Forest (CEGL006286), Oak - Hickory Forest (CEGL007267), and Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543). Because of this, there is greater representation of *Tsuga canadensis* (eastern hemlock), *Pinus virginiana* (Virginia pine), *Rhododendron maximum* (great laurel), and *Quercus* (oak) spp. rather than *Quercus prinus* (chestnut oak) compared to the global description. *Tsuga canadensis* (eastern hemlock) is also an important component in stands at New River Gorge but is lacking in most Virginia stands. GARI occurrences represent geographical outliers at the limits of the range of *Rhododendron catawbiense* (Catawba rosebay) in a landscape dominated by *Tsuga canadensis* (eastern hemlock) and *Rhododendron maximum* (great laurel).
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Five plots were sampled: GARI.31, GARI.65, GARI.75, GARI.115, and GARI.139.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus prinus - (Quercus coccinea, Quercus velutina)* Forest Alliance (A.248)
Alliance (English name)	Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance
Association	*Quercus prinus / Rhododendron catawbiense - Kalmia latifolia* Forest
Association (English name)	Chestnut Oak / Catawba Rosebay - Mountain Laurel Forest
Ecological System(s):	Central Appalachian Dry Oak-Pine Forest (CES202.591).

GLOBAL DESCRIPTION

Concept Summary: The documented range of this community is confined to the northern Virginia Blue Ridge, scattered locations in the Ridge and Valley province of west-central and southwestern Virginia, and in the gorges of the New and Gauley rivers of southern West Virginia. In addition, there are a few local outliers on sheltered, north-facing bluffs along the James River in the western Piedmont. In the main part of this association's range, stands are associated with strongly convex, upper slopes and spur crests at elevations from 325 m to over 975 m (1050–3200 ft). North or northwest aspects are common, but the type has been documented from other aspects as well, generally with high solar exposure. The vegetation is a

species-poor, open to closed-canopy forest of stunted (often <20 m tall, sometimes <10 m tall), gnarled trees over a dense, evergreen tall-shrub layer. *Quercus prinus* (chestnut oak) is the usual canopy dominant, with occasional associates of *Betula lenta* (sweet birch), *Tsuga canadensis* (eastern hemlock), *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), *Quercus alba* (white oak), *Nyssa sylvatica* (blackgum), *Acer rubrum* (red maple), *Pinus virginiana* (Virginia pine), and/or *Pinus strobus* (eastern white pine). *Rhododendron catawbiense* (Catawba rosebay), *Kalmia latifolia* (mountain laurel), and/or *Rhododendron maximum* (great laurel) (the latter primarily in West Virginia occurrences) dominate the shrub layer. Additional shrubs present at low cover include *Hamamelis virginiana* (American witchhazel), *Ilex montana* (mountain holly), and *Amelanchier arborea* (common serviceberry). Deciduous ericads such as *Gaylussacia baccata* (black huckleberry) and *Vaccinium pallidum* (Blue Ridge blueberry) may be present but rarely contribute more than 10% cover. Herbs and subshrubs are exceedingly sparse in the densely shaded, forest-floor environment; most likely to be encountered are the evergreen species *Gaultheria procumbens* (eastern teaberry), *Epigaea repens* (trailing arbutus), *Galax urceolata* (beetleweed), *Goodyera pubescens* (downy rattlesnake plantain), *Mitchella repens* (partridgeberry), and *Chimaphila maculata* (striped prince's pine), sometimes present at low cover.

Environmental Description: This type is generally associated with strongly convex, upper slopes, cliff tops, and spur crests at elevations from 325 m to over 975 m (1050–3200 ft). Plot-sampled stands have various aspects, with north or northwest aspects most common. Slopes are mostly steep, generally >20 degrees but sometimes as low as 10 degrees. Piedmont occurrences of this vegetation type differ somewhat from the main part of the range: they are confined to steep, sheltered bluffs subtending the James River at <200 m (650 ft) elevation. Site moisture potential appears to be in the subxeric to submesic range, with soils in plots described as well- to rapidly-drained, dry sandy loam and silty clay. Surface cover of rocks varies from low to high, and soils have thick, poorly decomposed duff layers. Soils are extremely acidic (mean pH = 4.1) and infertile, with low levels of most nutrients (Ca, Cu, K, Mg, Mn, P, Zn).

Vegetation Description: The vegetation is an exceptionally species-poor, open to closed-canopy forest of somewhat stunted (<20 m tall) to very stunted (<10 m tall), gnarled deciduous or mixed evergreen-deciduous trees over a dense, evergreen tall-shrub layer. *Quercus prinus* (chestnut oak) is the canopy dominant, with occasional associates of *Tsuga canadensis* (eastern hemlock), *Betula lenta* (sweet birch), *Nyssa sylvatica* (blackgum), *Acer rubrum* (red maple), *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Betula alleghaniensis* (yellow birch), *Pinus virginiana* (Virginia pine), and/or *Pinus strobus* (eastern white pine). *Acer rubrum* (red maple) and *Oxydendrum arboreum* (sourwood) may be abundant subcanopy trees. *Rhododendron catawbiense* (Catawba rosebay) and *Kalmia latifolia* (mountain laurel), each with mean cover of 25–50% in plots, dominate the shrub layer; *Rhododendron maximum* (great laurel) may be locally important in West Virginia occurrences. Additional shrubs present at low cover include *Acer pensylvanicum* (striped maple), *Gaylussacia baccata* (black huckleberry), *Hamamelis virginiana* (American witchhazel), *Ilex montana* (mountain holly), *Ilex opaca* (American holly), *Amelanchier arborea* (common serviceberry), *Smilax rotundifolia* (roundleaf greenbrier), *Vaccinium pallidum* (Blue Ridge blueberry), and *Viburnum acerifolium* (mapleleaf viburnum). Although not documented in plots, *Pieris floribunda* (mountain fetterbush) is reported to be a characteristic shrub of this community in the Thunder Ridge - Apple Orchard Mountain area of Virginia's Bedford and Botetourt counties (Rawinski et al. 1996). Herbs and subshrubs are

exceedingly sparse in the densely shaded forest floor environment, but the evergreen species *Gaultheria procumbens* (eastern teaberry), *Epigaea repens* (trailing arbutus), *Galax urceolata* (beetleweed), *Goodyera pubescens* (downy rattlesnake plantain), *Mitchella repens* (partridgeberry), and *Chimaphila maculata* (striped prince's pine) are sometimes present at low cover. Occasional herbs include *Aralia nudicaulis* (wild sarsaparilla), *Conopholis americana* (American squawroot), *Cypripedium acaule* (moccasin flower), *Dryopteris intermedia* (intermediate woodfern), *Hexastylis virginica* (Virginia heartleaf), and *Polypodium virginianum* (rock polypody). The bryophyte layer may have significant cover by *Leucobryum glaucum* (leucobryum moss); other bryophytes identified in plots include *Hypnum imponens* (hypnum moss), *Thuidium delicatulum* (delicate thuidium moss), *Dicranum scoparium* (dicranum moss), *Bazzania trilobata (common bazzania liverwort)*, and *Polytrichum juniperinum* (juniper polytrichum moss). Lichens collected from this community include *Cladonia caroliniana* (Carolina cup lichen), *Cladonia uncialis* (cup lichen), *Flavoparmelia baltimorensis*, and *Umbilicaria mammulata* (navel lichen). Vascular plant species richness (per 400 square meters) of Virginia plot-sampled stands ranges from 9 to 16 taxa (mean = 12); in the nine WV sampled plots it ranges from 13 to 33 taxa (mean = 22.4).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus prinus* (chestnut oak)
Shrub/sapling (tall & short)	Broad-leaved evergreen tree	*Rhododendron catawbiense* (Catawba rosebay)

Characteristic Species: *Aralia nudicaulis* (wild sarsaparilla), *Cypripedium acaule* (moccasin flower), *Gaultheria procumbens* (eastern teaberry), *Goodyera pubescens* (downy rattlesnake plantain), *Hamamelis virginiana* (American witchhazel), *Kalmia latifolia* (mountain laurel), *Quercus prinus* (chestnut oak), *Rhododendron catawbiense* (Catawba rosebay), *Tsuga canadensis* (eastern hemlock).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: The documented range of this community includes the southern part of the Central Appalachians and adjacent areas of the Southern Blue Ridge, Southern Ridge and Valley, and Cumberland Mountains in Virginia and West Virginia. In addition, there are a few local outliers on sheltered, north-facing bluffs along the James River in the western Virginia Piedmont.

States/Provinces: VA:S3, WV:S2.

Federal Lands: NPS (Appalachian Trail, Blue Ridge Parkway, Gauley River, New River Gorge); USFS (Jefferson).

CONSERVATION STATUS

Rank: G3? (25-Feb-2004).

Reasons: This association appears to be a geographically-limited, environmentally-restricted, and mostly small-patch vegetation type of oligotrophic, somewhat exposed habitats.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: The geographic distribution of this community and the extent to which it recurs throughout the Northern Blue Ridge and Ridge and Valley are somewhat uncertain and need further investigation. Although documented by plot data only on the Blue Ridge of Virginia and at New River Gorge and the Gauley River in West Virginia, similar vegetation is reported to be

frequent on xeric, rocky upper slopes and summits throughout the west-central and southwestern Virginia Ridge and Valley region (T.F. Wieboldt pers. comm.). These putative Ridge and Valley occurrences sometimes contain mixtures of *Rhododendron catawbiense* (Catawba rosebay) and *Rhododendron maximum* (great laurel), as do the Gauley River occurrences. For the most part, however, this community appears to reach optimal development in geographic areas (i.e., the Northern Blue Ridge) and drier habitats where *Rhododendron maximum* (great laurel) is spotty or absent. *Tsuga canadensis* (eastern hemlock) is prominent in this association at New River Gorge and the Gauley River, another contrast to Virginia stands. This association (CEGL008524) is not likely to be found in the Southern Blue Ridge, where *Rhododendron catawbiense* (Catawba rosebay) is more restricted to high elevations and exposed habitats, above the elevational limits of *Quercus prinus* (chestnut oak) (Newell 1997, A.S. Weakley pers. comm.). Although stands of this type can be rather difficult to plot-sample, the collection of additional quantitative data from well developed occurrences would be desirable. This community type is similar to and sometimes co-occurs with *Tsuga caroliniana / Kalmia latifolia - Rhododendron catawbiense* Forest (CEGL007139) on the Northern Blue Ridge. The degree to which periodic fires have influenced the structure and composition of this community type needs investigation.

Similar Associations:

- *Fagus grandifolia - Quercus alba / Kalmia latifolia - (Symplocos tinctoria, Rhododendron catawbiense) / Galax urceolata* Forest (CEGL004539).
- *Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest (CEGL006286)--is a more mesophytic forest of protected slopes, with substantial *Quercus rubra* and a *Rhododendron maximum* understory.
- *Tsuga caroliniana / Kalmia latifolia - Rhododendron catawbiense* Forest (CEGL007139).

Related Concepts:

- *Quercus montana - Pinus strobus / Kalmia latifolia / Gaylussacia baccata* Forest (Coulling and Rawinski 1999) ?
- *Quercus montana / Kalmia latifolia / Vaccinium pallidum* Association: *Rhododendron catawbiense / Galax urceolata* Subassociation (Rawinski et al. 1996) ?
- *Quercus montana / Rhododendron catawbiense - Kalmia latifolia* Forest (Fleming et al. 2006) =
- *Quercus prinus / Rhododendron catawbiense - Kalmia latifolia* Forest (Fleming and Coulling 2001) =
- *Quercus rubra - Tsuga canadensis / Rhododendron catawbiense* Association, *pro parte* (Rawinski et al. 1996) ?
- Chestnut Oak: 44 (Eyre 1980) B
- Oak / Heath Forest (Fleming and Coulling 2001) B

SOURCES

Description Authors: G. Fleming and P. Coulling, mod. S. C. Gawler.

References: Coulling and Rawinski 1999, Eyre 1980, Fleming and Coulling 2001, Fleming and Patterson 2009a, Fleming et al. 2001, Fleming et al. 2004, Fleming et al. 2006, Newell 1997, Rawinski et al. 1996, Vanderhorst et al. 2007, Vanderhorst et al. 2010, Wieboldt pers. comm.

Plot GARI.139. Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest.

COMMON NAME (PARK-SPECIFIC): OAK - HICKORY - SUGAR MAPLE FOREST

SYNONYMS

USNVC English Name:	**Chestnut Oak - Shagbark Hickory - Northern Red Oak / Sugar Maple Forest**
USNVC Scientific Name:	***Quercus prinus - Carya ovata - Quercus rubra / Acer saccharum* Forest**
USNVC Identifier:	**CEGL007268**

LOCAL INFORMATION

Environmental Description: This association occurs on gorge slopes and plateaus on soils with intermediate moisture regimes (dry-mesic) and relatively high fertility. Most environmental and topographic variables have intermediate means and broad ranges, suggesting that its niche is defined by an interaction of compensatory factors. It occurs on all aspects and average solar exposure of mapped polygons is intermediate. Slopes in mapped polygons range from 0.7 to 48 degrees (mean = 22.5). Elevations in mapped polygons range from 209 to 597 m (mean = 400.9). Bedrock geology is mapped as sandstones and shales of the New River and Kanawha formations of the Pottsville group. Occurrences are more abundant and cover larger areas in the west end of the park where the Kanawha formation becomes more prevalent. Unvegetated ground cover is dominated by litter and rock. Soils in plots are described as well-drained, dry to somewhat moist sandy loam, sandy clay loam, silt loam, and loam. Soils test slightly to extremely acidic (mean pH = 4.70) with relatively high levels of estimated N release, Al, and K, and relatively low levels of organic matter compared to average values from all plots in the park. In the western part of the park where deciduous forests predominate, adjacent vegetation includes Oak - Hickory Forest (CEGL007268) on drier, less fertile soils and Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222) on moister, more fertile soils. In the east end of the park, occurrences are mostly small patches imbedded within the matrix Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543).

Vegetation Description: This association is a deciduous forest with a canopy dominated by species of *Quercus* (oak) and *Carya* (hickory) with an abundance of *Acer saccharum* var. *saccharum* (sugar maple) in the subcanopy. Canopies are tall (>20 m) with cover ranging from 50 to 90%. Important canopy trees in plots include (in decreasing order of constancy) *Quercus rubra* (northern red oak), *Quercus prinus* (chestnut oak), *Acer saccharum* var. *saccharum* (sugar maple), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Carya glabra* (pignut hickory), *Carya alba* (mockernut hickory), and *Carya ovata* (shagbark hickory). Cover in the subcanopy of plots ranges from 20 to 60% and is usually dominated by *Acer saccharum* var. *saccharum* (sugar maple). *Acer rubrum* (red maple) may also be common in the subcanopy with lower cover. The vines *Toxicodendron radicans* (eastern poison ivy), *Vitis aestivalis* (summer grape), and *Parthenocissus quinquefolia* (Virginia creeper) may reach the subcanopy. Common species in the tall-shrub layer include *Cercis canadensis* var. *canadensis* (eastern redbud), *Ostrya virginiana* (hophornbeam), *Cornus florida* (flowering dogwood), and *Amelanchier arborea* var. *arborea* (common serviceberry). Species with high constancy in the short-shrub layer include *Smilax rotundifolia* (roundleaf greenbrier), *Viburnum acerifolium* (mapleleaf viburnum), *Smilax glauca* (cat greenbrier), *Sassafras albidum* (sassafras), and *Hydrangea arborescens* (wild hydrangea). There is sparse to moderately high cover in the herb layer. Common herbs in plots include (in decreasing order of constancy) *Dioscorea quaternata* (fourleaf yam), *Polystichum*

acrostichoides (Christmas fern), *Eurybia divaricata* (white wood aster), *Solidago caesia* (wreath goldenrod), *Galium circaezans* (licorice bedstraw), *Carex laxiflora* (broad looseflower sedge), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Ageratina altissima* var. *altissima* (white snakeroot), *Dichanthelium boscii* (Bosc's panicgrass), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Carex digitalis* var. *digitalis* (slender woodland sedge), *Brachyelytrum erectum* (bearded shorthusk), and *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit). Vascular plant species richness in plots ranges from 35 to 61 taxa (mean = 47.4). Mosses identified in plots include *Thuidium delicatulum* (delicate thuidium moss), *Leucobryum albidum* (leucobryum moss), *Brachythecium oxycladon* (brachythecium moss), *Dicranum fulvum* (dicranum moss), *Dicranum scoparium* (dicranum moss), *Hypnum imponens* (hypnum moss), *Climacium americanum* (American climacium moss), and *Leucobryum glaucum* (leucobryum moss).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association is found throughout the park where environmental conditions are appropriate, patchier in the eastern portion.

Classification Comments: This association is floristically and environmentally intermediate between Oak - Hickory Forest (CEGL007267) and Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222). In cluster analysis, plots of this association form two main groups that mix with plots of these two related types. Recognition of this association is based on dominance of *Quercus* (oak) spp. in the canopy with abundance of *Acer saccharum* var. *saccharum* (sugar maple) in the lower strata.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Twelve plots were sampled: GARI.39, GARI.53, GARI.157, GARI.170, GARI.174, GARI.178, GARI.183, GARI.185, GARI.187, GARI.190, GARI.197, and GARI.202.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus prinus - Quercus (alba, falcata, rubra, velutina)* Forest Alliance (A.249)
Alliance (English name)	Chestnut Oak - (White Oak, Southern Red Oak, Northern Red Oak, Black Oak) Forest Alliance
Association	*Quercus prinus - Carya ovata - Quercus rubra / Acer saccharum* Forest
Association (English name)	Chestnut Oak - Shagbark Hickory - Northern Red Oak / Sugar Maple Forest
Ecological System(s):	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898). Southern Appalachian Oak Forest (CES202.886).

GLOBAL DESCRIPTION

Concept Summary: These dry-mesic forests of the Ridge and Valley and adjacent sedimentary ecoregions (Cumberlands, Interior Low Plateau) occur on ridges, gorge slopes, spurs, and knobs. Elevations range from 250 to 1000 m (800–3250 ft). Soils are very well-drained, acidic to circumneutral, and derived from sandstone and shales. The canopy is dominated by *Quercus prinus* (chestnut oak) with other oaks and hickories, typically with *Acer saccharum* (sugar maple) as a canopy associate and/or subcanopy dominant. Some examples are strongly dominated by *Quercus prinus* (chestnut oak). Other examples with more diverse canopies include *Quercus rubra* (northern red oak), *Carya ovata* (shagbark hickory), *Carya glabra* (pignut hickory), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), and *Quercus velutina* (black oak). The canopy is generally closed (greater than 75% cover). The subcanopy may be dominated by *Acer saccharum* (sugar maple) in some examples. Other subcanopy species may include *Carya ovata* (shagbark hickory), *Carya glabra* (pignut hickory), *Quercus rubra* (northern red oak), *Quercus muehlenbergii* (chinkapin oak), *Aesculus flava* (yellow buckeye), and *Juniperus virginiana* (eastern red-cedar). The subcanopy is relatively sparse with cover less than 25%. The shrub and herbaceous layers are sparse with small stems of canopy and subcanopy species along with herbaceous species such as *Actaea racemosa* (black bugbane), *Ageratina altissima* (white snakeroot), *Arisaema triphyllum* (Jack in the pulpit), *Asplenium platyneuron* (ebony spleenwort), *Bromus pubescens* (hairy woodland brome), *Carex albursina* (white bear sedge), *Carex cumberlandensis* (Cumberland sedge), *Carex laxiflora* (broad looseflower sedge), *Campanulastrum americanum* (American bellflower), *Chimaphila maculata* (striped prince's pine), *Dichanthelium boscii* (Bosc's panicgrass), *Dioscorea quaternata* (fourleaf yam), *Eurybia divaricata* (white wood aster), *Galium circaezans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Geranium maculatum* (spotted geranium), *Houstonia longifolia* (longleaf summer bluet), *Polystichum acrostichoides* (Christmas fern), *Prosartes lanuginosa* (yellow fairybells), *Sanicula canadensis* (Canadian blacksnakeroot), *Sedum ternatum* (woodland stonecrop), *Solidago caesia* (wreath goldenrod), *Vicia caroliniana* (Carolina vetch), *Viola* (violet) spp., and *Zizia trifoliata* (meadow alexanders).

Environmental Description: In the Ridge and Valley of Tennessee, these forests occur near the tops of calcareous ridges and knobs with northerly aspects that range from 250 to 1000 m (800–3250 ft) elevation, on very well-drained, gravelly, sandy soils and exposed topographical positions (Andreu and Tukman 1995). On the Tellico Pilot Project study site, many stands were found on the Dandridge, Tellico, and Steekee soil series. The Tellico series is an Ultisol, while the others are Inceptisols; all can be described as well- to excessively well-drained soils. The Tellico and Steekee soils are strongly or very strongly acidic. The Dandridge soils are slightly acidic neutral or mildly alkaline. At New River Gorge and the nearby Bluestone River, as well as parts of the Gauley River in West Virginia, this association is the predominant upland forest type on lower to upper colluvial gorge slopes of intermediate soil moisture and fertility with relatively warm, dry aspects. It also occurs in smaller patches on plateaus, ridge spurs and convex upper slopes, often north-facing. Stands occur both on sandstones of the Pottsville group and on shales of the Mauch Chunk group. Elevations of mapped stands range from 209 to 985 m. Slopes range from flat to very steep (0 to 51 degrees, mean = 24 degrees). Soils are mostly well-drained, dry to somewhat moist, sandy to clay loams mapped in the Calvin, Dekalb, and Gilpin series. Soil chemistry analyzed from 10 plots indicates extremely acidic to slightly acidic soils (mean pH = 4.92) with intermediate levels of most nutrients and somewhat higher levels of some nutrients (Al, K, Mg, Mn, P) compared to other nearby community types.

Vegetation Description: This association is a closed-canopy (or occasionally somewhat open-canopy) deciduous forest dominated by species of *Quercus* (oak), often with *Carya* (hickory) spp., and characteristically with an abundance of *Acer saccharum* (sugar maple) in the canopy and/or shrub layers. *Quercus prinus* (chestnut oak) is the most typical canopy dominant; other dominants can include *Quercus rubra* (northern red oak), *Acer saccharum* (sugar maple), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Fraxinus americana* (white ash), *Carya glabra* (pignut hickory), *Carya alba* (mockernut hickory), and *Carya ovata* (shagbark hickory). *Liriodendron tulipifera* (tuliptree) may be a canopy associate. Subcanopy species include *Carya ovata* (shagbark hickory), *Carya glabra* (pignut hickory), *Quercus rubra* (northern red oak), *Quercus muehlenbergii* (chinkapin oak), *Acer saccharum* (sugar maple), *Aesculus flava* (yellow buckeye), *Tilia americana* (American basswood), *Acer rubrum* (red maple), and *Juniperus virginiana* (eastern red-cedar). The subcanopy may be dominated by *Acer saccharum* (sugar maple) in some examples. Vines, which may occur in the understory or reach into the canopy, include *Aristolochia macrophylla* (pipevine), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), and *Vitis aestivalis* var. *bicolor* (summer grape). Common tall shrubs or short trees include *Amelanchier arborea* var. *arborea* (common serviceberry), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Halesia tetraptera* (mountain silverbell), *Hamamelis virginiana* (American witchhazel), *Ostrya virginiana* (hophornbeam), and *Viburnum rafinesquianum* (downy arrow-wood). The shrub and herbaceous layers include small stems of canopy and subcanopy species along with herbaceous species. The most common shrubs are *Viburnum acerifolium* (mapleleaf viburnum) and *Smilax rotundifolia* (roundleaf greenbrier); *Smilax glauca* (cat greenbrier), *Sassafras albidum* (sassafras), and/or *Hydrangea arborescens* (wild hydrangea) may also be present. Common herbs include *Actaea racemosa* (black bugbane), *Ageratina altissima* (white snakeroot), *Arisaema triphyllum* (Jack in the pulpit), *Asplenium platyneuron* (ebony spleenwort), *Brachyelytrum erectum* (bearded shorthusk), *Bromus pubescens* (hairy woodland brome), *Carex albursina* (white bear sedge), *Carex cumberlandensis* (Cumberland sedge), *Carex digitalis* (slender woodland sedge), *Carex laxiflora* (broad looseflower sedge), *Campanulastrum americanum* (American bellflower), *Chimaphila maculata* (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Dioscorea quaternata* (fourleaf yam), *Eurybia divaricata* (white wood aster), *Galium circaezans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Geranium maculatum* (spotted geranium), *Houstonia longifolia* (longleaf summer bluet), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Polystichum acrostichoides* (Christmas fern), *Prosartes lanuginosa* (yellow fairybells), *Sanicula canadensis* (Canadian blacksnakeroot), *Sedum ternatum* (woodland stonecrop), *Solidago caesia* (wreath goldenrod), *Vicia* (vetch) *caroliniana*, *Viola* (violet) spp., and *Zizia trifoliata* (meadow alexanders). Vascular plant species richness in 38 400-square-meter sampled plots at New and Gauley rivers, West Virginia, range from 27 to 61 taxa (mean = 43.7).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple) *Carya glabra* (pignut hickory)
Tree canopy	Broad-leaved deciduous tree	*Quercus alba* (white oak) *Quercus prinus* (chestnut oak) *Quercus rubra* (northern red oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Shrub/sapling (tall & short)	Vine/Liana	*Smilax rotundifolia* (roundleaf greenbrier)

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous tree	*Quercus prinus* (chestnut oak)
Herb (field)	Fern or fern ally	*Pleopeltis polypodioides* ssp. *polypodioides* (resurrection fern)

Characteristic Species: *Actaea racemosa* (black bugbane), *Ageratina altissima* (white snakeroot), *Arisaema triphyllum* (Jack in the pulpit), *Carex albursina* (white bear sedge), *Dioscorea quaternata* (fourleaf yam), *Eurybia divaricata* (white wood aster), *Galium circaezans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Geranium maculatum* (spotted geranium), *Maianthemum racemosum* (feathery false lily of the valley), *Parthenocissus quinquefolia* (Virginia creeper), *Polystichum acrostichoides* (Christmas fern), *Prosartes lanuginosa* (yellow fairybells), *Quercus rubra* (northern red oak), *Sanicula canadensis* (Canadian blacksnakeroot), *Sedum ternatum* (woodland stonecrop), *Solidago caesia* (wreath goldenrod), *Viburnum acerifolium* (mapleleaf viburnum).

Other Noteworthy Species:

Species	GRank	Type	Note
Berberis canadensis (American barberry)	G3	plant	globally vulnerable
Monarda fistulosa ssp. *brevis* (smoke hole bergamot)	G5T1	plant	critically imperiled

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: These dry-mesic forests are found in the Ridge and Valley and adjacent sedimentary ecoregions (Cumberlands, Interior Low Plateau) of the southeastern United States, ranging from Kentucky and Tennessee to West Virginia and perhaps Virginia.

States/Provinces: AL:S1, KY?, TN, VA?, WV.

Federal Lands: DOE (Oak Ridge); NPS (Bluestone, Gauley River, New River Gorge, Russell Cave); TVA (Tellico); USFS (Cherokee?).

CONSERVATION STATUS

Rank: G4? (9-Oct-2001).

Reasons: This community is believed to be relatively common and secure, although good mature examples of large size may be uncommon. Additional information is needed relative to its distribution and relation to other similar communities. The rank was formerly G3G5, and changing it to G4? (which is equivalent) makes it clear that this is not to be considered a rare community type.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Two variants of this association (14 stands sampled; 19 stands sampled) were described from Tellico Pilot Project (Ridge and Valley of Tennessee, northeast Monroe County). It has also been sampled at New River Gorge, Bluestone River, and Gauley River in West Virginia. This may be similar to vegetation reported from limestone in the Ridge and Valley of Virginia.

Similar Associations:

- *Liriodendron tulipifera - Tilia americana* var. *heterophylla - Aesculus flava - Acer saccharum / (Magnolia tripetala)* Forest (CEGL005222).
- *Quercus prinus - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (CEGL007267).
- *Quercus prinus - Quercus rubra - Carya (ovata, glabra) - Pinus virginiana* Forest (CEGL007269).
- *Quercus prinus - Quercus* spp. / *Vaccinium arboreum - (Kalmia latifolia, Styrax grandifolius)* Forest (CEGL007700).

Related Concepts:

- *Quercus prinus - Quercus rubra - (Quercus alba) - Liriodendron tulipifera - Acer rubrum / Parthenocissus quinquefolia* forest (Vanderhorst 2001b) B
- Chestnut Oak Forest (Oberholster 1993) B
- Chestnut Oak, RV (Pyne 1994) B
- Chestnut Oak: 44 (Eyre 1980) B
- IA6d. Chestnut Oak Slope and Ridge Forest (Allard 1990) ?
- White Oak - Northern Red Oak - Black Oak (Rentch et al. 2005) ?

SOURCES

Description Authors: M. Andreu and M. Tukman, mod. S. C. Gawler.

References: Allard 1990, Andreu and Tukman 1995, Evans 1991, Eyre 1980, Oberholster 1993, Pyne 1994, Rentch et al. 2005, Schotz pers. comm., Southeastern Ecology Working Group n.d., Sponaugle et al. 1984, TDNH unpubl. data, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2008, Vanderhorst et al. 2010.

Plot GARI.202. Oak - Hickory - Sugar Maple Forest.

COMMON NAME (PARK-SPECIFIC): OAK - HICKORY FOREST

SYNONYMS

USNVC English Name: **Chestnut Oak - (Northern Red Oak) - Hickory species / Sourwood - Flowering Dogwood Forest**

USNVC Scientific Name: ***Quercus prinus* - (*Quercus rubra*) - *Carya* spp. / *Oxydendrum arboreum* - *Cornus florida* Forest**

USNVC Identifier: **CEGL007267**

LOCAL INFORMATION

Environmental Description: This association occurs in small to large patches in relatively warm, dry sites with relatively low soil fertility. It occurs in small patches, mostly on upper slopes, in the east end of the park and becomes the matrix community in all slope positions on warm aspects in the west end of the park. It occurs on plateaus, ridges, and gorge slopes. Mean solar exposure of mapped polygons is relatively high and aspects are mostly southeast to southwest to northwest. Slopes in mapped polygons range from 0.4–48 degrees (mean = 19.5). Elevations in mapped polygons range from 220–612 m (mean = 397.8). Bedrock geology is mapped as sandstones and shales of the New River and Kanawha formations of the Pottsville group. Surficial geology in plots is mostly sandstone. Unvegetated groundcover is dominated by litter and rock. Soils in plots are described as well to rapidly drained, dry to somewhat moist sandy loam, sandy clay loam, sandy silt loam, silt loam, and clay loam. Soils test slightly to extremely acidic (mean pH = 4.59) with relatively high levels of estimated N release and Al, and relatively low levels of Ca, Fe, Mg, and Zn compared to average values from all plots in the park. This association is often adjacent to and grades towards Oak - Hickory - Sugar Maple Forest (CEGL007268), which occurs in more mesic or more fertile sites, and Oak / Ericad Forest (CEGL006271), which occurs in more xeric sites. In the east end of the park, it is often embedded in the matrix Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543).

Vegetation Description: This association is a mostly deciduous forest dominated by species of *Quercus* (oak) and *Carya* (hickory). Canopies are usually tall (>20 m) with cover in plots ranging from 30–80%. Codominant canopy trees include (in decreasing order of constancy in plots) *Carya alba* (mockernut hickory), *Quercus velutina* (black oak), *Quercus prinus* (chestnut oak), *Liriodendron tulipifera* (tuliptree), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus coccinea* var. *coccinea* (scarlet oak), and *Fagus grandifolia* (American beech). The conifer *Tsuga canadensis* (eastern hemlock) sometimes occurs with low cover. Cover in the subcanopy of plots ranges from 10–70% with species of *Quercus* (oak) less well-represented than in the canopy. Important subcanopy trees include *Acer rubrum* (red maple), *Carya alba* (mockernut hickory), *Oxydendrum arboreum* (sourwood), *Quercus alba* (white oak), *Fagus grandifolia* (American beech), *Acer saccharum* var. *saccharum* (sugar maple), and *Nyssa sylvatica* (blackgum). Cover in the tall-shrub layer of plots ranges from 1–40% with high representation by saplings of the shade-tolerant canopy trees. Additional small trees and shrubs in this layer include *Cornus florida* (flowering dogwood), *Hamamelis virginiana* (American witchhazel), *Ilex opaca* var. *opaca* (American holly), and *Rhododendron maximum* (great laurel) (with low cover). Cover in the short-shrub layer of plots ranges from 1–20%; common species include *Smilax rotundifolia* (roundleaf greenbrier), *Rubus* (blackberry) spp., *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), *Sassafras albidum* (sassafras),

Toxicodendron radicans (eastern poison ivy), *Viburnum acerifolium* (mapleleaf viburnum), and *Vaccinium pallidum* (Blue Ridge blueberry). Cover in the herb layer of plots ranges from 1 to 40%. Herbs with high constancy include *Polystichum acrostichoides* (Christmas fern), *Carex digitalis* var. *digitalis* (slender woodland sedge), *Dioscorea quaternata* (fourleaf yam), *Solidago caesia* (wreath goldenrod), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Dichanthelium boscii* (Bosc's panicgrass), *Viola hastata* (halberdleaf yellow violet), *Potentilla simplex* (common cinquefoil), *Eurybia divaricata* (white wood aster), *Desmodium nudiflorum* (nakedflower ticktrefoil), and *Carex communis* var. *communis*. Vascular plant species richness in plots ranges from 28–78 taxa (mean = 43.2). Nonvascular cover in plots ranges from 0 to 40% and is dominated by mosses. Common mosses include *Thuidium delicatulum* (delicate thuidium moss), *Leucobryum glaucum* (leucobryum moss), *Hypnum imponens* (hypnum moss), *Polytrichum ohioense* (Ohio polytrichum moss), *Leucobryum albidum* (leucobryum moss), and *Dicranum fulvum* (dicranum moss).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	.	.	[not crosswalked]	.

Local Range: Occurrences are scattered on gorge slopes and plateaus throughout the park. It is more abundant on river right (on the right looking downstream) and in the west end of the park.

Classification Comments: This association is floristically and environmentally intermediate between Oak - Hickory - Sugar Maple Forest (CEGL007268) and Oak / Ericad Forest (CEGL006271). In cluster analysis, plots of this association form two main groups which mix with plots of these two related types. Generally low cover of *Acer saccharum* var. *saccharum* (sugar maple) and *Kalmia latifolia* (mountain laurel) helps distinguish this association from these two types, respectively.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Twenty-three plots were sampled: GARI.34, GARI.44, GARI.64, GARI.85, GARI.93, GARI.111, GARI.114, GARI.120, GARI.133, GARI.142, GARI.144, GARI.147, GARI.151, GARI.153, GARI.160, GARI.161, GARI.168, GARI.182, GARI.188, GARI.198, GARI.199, GARI.206, and GARI.212.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus prinus - Quercus rubra* Forest Alliance (A.250)
Alliance (English name)	Chestnut Oak - Northern Red Oak Forest Alliance
Association	*Quercus prinus - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest
Association (English name)	Chestnut Oak - (Northern Red Oak) - Hickory species / Sourwood - Flowering Dogwood Forest

Ecological System(s): Southern Appalachian Oak Forest (CES202.886).

GLOBAL DESCRIPTION

Concept Summary: This community is known from low to intermediate elevations of the Southern Blue Ridge escarpment, the Great Smoky Mountains, Piedmont transition areas, into the Southern Ridge and Valley, and in the Cumberlands in southern West Virginia. It occurs on relatively exposed landforms below 1000 m (3280 ft) elevation (220–1000 m [700–3280 ft]), on nearly level to steep, convex, middle to upper slopes, ridges, and plateaus, with mostly northwestern to southeastern aspects. These are forests characterized by canopies dominated by *Quercus* (oak) and *Carya* (hickory) species that do not have a well-developed heath shrub layer. *Acer rubrum* (red maple) and *Liriodendron tulipifera* (tuliptree) may have significant coverage, apparently related to logging history. The predominant oaks and hickories in the canopy are *Quercus prinus* (chestnut oak), *Carya glabra* (pignut hickory), *Carya alba* (mockernut hickory), *Carya ovata* (shagbark hickory), *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak). Additional canopy and subcanopy species can include *Nyssa sylvatica* (blackgum), *Magnolia fraseri* (mountain magnolia), *Halesia tetraptera* var. *monticola* (mountain silverbell), *Fagus grandifolia* (American beech), *Ilex opaca* (American holly), and *Oxydendrum arboreum* (sourwood). *Cornus florida* (flowering dogwood) is characteristic and may be dominant in the subcanopy and tall-shrub layers; other tall-shrub species include *Magnolia fraseri* (mountain magnolia), *Hamamelis virginiana* (American witchhazel), and *Sassafras albidum* (sassafras). *Kalmia latifolia* (mountain laurel) or *Rhododendron maximum* (great laurel) may be present but only at very low cover. The short-shrub stratum is sparse (up to 20% cover), with no clear dominant. Some typical shrub species include *Vaccinium pallidum* (Blue Ridge blueberry), *Viburnum acerifolium* (mapleleaf viburnum), and (in the central and southern portions of the type's range) *Gaylussacia ursina* (bear huckleberry), *Hydrangea arborescens* (wild hydrangea), and *Hydrangea radiata* (silverleaf hydrangea). Common vines are *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), *Vitis aestivalis* (summer grape), *Vitis rotundifolia* (muscadine), and *Vitis vulpina* (frost grape). Herb cover is sparse to moderate; diversity and species composition vary among occurrences. Some of the more typical herb species include *Eurybia divaricata* (white wood aster), *Dioscorea quaternata* (fourleaf yam), *Maianthemum racemosum* (feathery false lily of the valley), *Polystichum acrostichoides* (Christmas fern), *Solidago caesia* (wreath goldenrod), *Uvularia perfoliata* (perfoliate bellwort), and *Uvularia puberula* (mountain bellwort).

Environmental Description: This community is known from plateaus, ridges, and gorge slopes at low to intermediate elevations, on relatively exposed landforms from 220 to 1000 m (700–3250 ft) elevation. Slopes are moderately steep to steep where it occurs on convex, middle to upper slopes, grading to gentle on ridges and plateaus; aspects are mostly northern to southwestern. Unvegetated ground cover is dominated by litter and rock. In Virginia, the type occurs on sites underlain by colluvial and alluvial fan material, sandstone, quartzite, and rocks of the Northern Blue Ridge granitic complex. Farther south, soils are weathered from sandstones and, less commonly, shales and are strongly acidic, relatively nutrient-poor and sandy to loamy in texture. Soils in West Virginia plots are well- to rapidly-drained, dry to somewhat moist sandy loam, sandy clay loam, sandy silt loam, silt loam, and clay loam, and test slightly to extremely acidic (mean pH = 4.59). Soil chemistry data from 25 plot samples from throughout the range indicate that mean conditions are extremely acidic, with low levels of calcium, magnesium, and

total base saturation, along with moderately high iron and aluminum (Fleming and Patterson 2009a).

Vegetation Description: These are forests dominated by species of *Quercus* (oak) and *Carya* (hickory) and without a well-developed heath shrub layer. *Acer rubrum* (red maple) and *Liriodendron tulipifera* (tuliptree) may have significant coverage, apparently related to logging history. The predominant oaks and hickories in the canopy are *Quercus prinus* (chestnut oak), *Carya glabra* (pignut hickory), *Carya alba* (mockernut hickory), *Carya ovata* (shagbark hickory), *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak). Additional canopy and subcanopy species can include *Nyssa sylvatica* (blackgum), *Magnolia fraseri* (mountain magnolia), *Halesia tetraptera* var. *monticola* (mountain silverbell), *Fagus grandifolia* (American beech), *Ilex opaca* (American holly), and *Oxydendrum arboreum* (sourwood). *Cornus florida* (flowering dogwood) is characteristic and may be dominant in the subcanopy and tall-shrub layers; other tall-shrub species include *Magnolia fraseri* (mountain magnolia), *Hamamelis virginiana* (American witchhazel), and *Sassafras albidum* (sassafras). *Kalmia latifolia* (mountain laurel) or *Rhododendron maximum* (great laurel) may be present but only at very low cover. The short-shrub stratum is sparse (up to 20% cover), with no clear dominant. Some typical shrub species include *Vaccinium pallidum* (Blue Ridge blueberry), *Viburnum acerifolium* (mapleleaf viburnum), and (in the central and southern portions of the type's range) *Gaylussacia ursina* (bear huckleberry), *Hydrangea arborescens* (wild hydrangea), and *Hydrangea radiata* (silverleaf hydrangea). Common vines are *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), *Vitis aestivalis* (summer grape), *Vitis rotundifolia* (muscadine), and *Vitis vulpina* (frost grape). Herb cover is sparse to moderate; diversity and species composition vary among occurrences. Some of the more typical species include *Ageratina altissima* (white snakeroot), *Eurybia divaricata* (white wood aster), *Carex communis* var. *communis*, *Carex digitalis* var. *digitalis* (slender woodland sedge), *Chimaphila maculata* (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium* (rosette grass) spp. (e.g., *Dichanthelium boscii* (Bosc's panicgrass), *Dichanthelium commutatum* (variable panicgrass), *Dichanthelium dichotomum* (cypress panicgrass)), *Dioscorea quaternata* (fourleaf yam), *Galium circaezans* (licorice bedstraw), *Galium latifolium* (purple bedstraw), *Goodyera pubescens* (downy rattlesnake plantain), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Medeola virginiana* (Indian cucumber), *Houstonia purpurea* (Venus' pride), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Polystichum acrostichoides* (Christmas fern), *Prenanthes* (rattlesnakeroot) spp., *Solidago caesia* (wreath goldenrod), *Thalictrum thalictroides* (rue-anemone), *Thelypteris noveboracensis* (New York fern), *Uvularia perfoliata* (perfoliate bellwort), *Uvularia puberula* (mountain bellwort), *Uvularia sessilifolia* (sessileleaf bellwort), and *Viola* (violet) spp. (e.g., *Viola blanda* (sweet white violet), *Viola hastata* (halberdleaf yellow violet), *Viola X palmata* (early blue violet), *Viola tripartita* (threepart violet)). Common mosses from West Virginia plots include *Thuidium delicatulum* (delicate thuidium moss), *Leucobryum glaucum* (leucobryum moss), *Hypnum imponens* (hypnum moss), *Polytrichum ohioense* (Ohio polytrichum moss), *Leucobryum albidum* (leucobryum moss), and *Dicranum fulvum* (dicranum moss).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer rubrum* (red maple) *Carya alba* (mockernut hickory) *Carya glabra* (pignut hickory) *Carya ovata* (shagbark hickory) *Liriodendron tulipifera* (tuliptree) *Quercus alba* (white oak) *Quercus velutina* (black oak)
Tree canopy	Broad-leaved deciduous tree	*Quercus prinus* (chestnut oak) *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Cornus florida* (flowering dogwood)

Characteristic Species: *Acer pensylvanicum* (striped maple), *Acer rubrum* (red maple), *Ageratina altissima* (white snakeroot), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Castanea dentata* (American chestnut), *Cornus florida* (flowering dogwood), *Dioscorea quaternata* (fourleaf yam), *Eurybia divaricata* (white wood aster), *Galium circaezans* (licorice bedstraw), *Goodyera pubescens* (downy rattlesnake plantain), *Liriodendron tulipifera* (tuliptree), *Maianthemum racemosum* (feathery false lily of the valley), *Medeola virginiana* (Indian cucumber), *Nyssa sylvatica* (blackgum), *Parthenocissus quinquefolia* (Virginia creeper), *Polystichum acrostichoides* (Christmas fern), *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Solidago caesia* (wreath goldenrod), *Thelypteris noveboracensis* (New York fern), *Toxicodendron radicans* (eastern poison ivy), *Uvularia perfoliata* (perfoliate bellwort), *Uvularia puberula* (mountain bellwort).

Other Noteworthy Species:

Species	GRank	Type	Note
Ageratina altissima var. *roanensis* (white snakeroot)	G5T3T4	plant	
Carex lucorum var. *austrolucorum* (Blue Ridge sedge)	G4T3T4	plant	
Isotria medeoloides (green fiveleaf orchid)	G2	plant	Federally listed threatened; globally imperiled
Monotropsis odorata (pygmypipes)	G3	plant	
Solidago glomerata (clustered goldenrod)	G3	plant	
Tsuga caroliniana (Carolina hemlock)	G3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge, the Great Smoky Mountains, and Piedmont transition areas of western North Carolina, eastern Tennessee, northwestern South Carolina, and northeastern Georgia, extending north into the Cumberlands in southern West Virginia and the border area between Virginia, Kentucky, and Tennessee. It also extends north in the Virginia Ridge and Valley and Blue Ridge to Allegheny, Botetourt, and Bedford counties.
States/Provinces: GA, KY, NC, SC, TN, VA:S3S4, WV.
Federal Lands: BIA (Eastern Band of Cherokee); NPS (Appalachian Trail, Blue Ridge Parkway, Carl Sandburg Home, Cumberland Gap, Gauley River, Great Smoky Mountains, New River Gorge); USFS (Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Cherokee, George Washington, Jefferson, Nantahala, Pisgah, Sumter, Sumter (Mountains), Sumter (Piedmont)).

CONSERVATION STATUS

Rank: G4G5 (15-Aug-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This forest lacks the dense ericaceous shrub layer typical of other *Quercus prinus* (chestnut oak)-dominated forests in the Blue Ridge escarpment region and commonly has diverse herbaceous composition. It is distinguished from similar forests in the Ridge and Valley by lacking *Acer saccharum* (sugar maple) and from Piedmont forests by the lack of *Quercus falcata* (southern red oak) and *Quercus stellata* (post oak), and by the presence of species more typical of the Southern Appalachians (*Magnolia fraseri* (mountain magnolia), *Halesia tetraptera* (mountain silverbell), and *Castanea dentata* (American chestnut)). This association was originally defined from the Chattooga Basin Project (S. Simon pers. comm.) and later refined with information from the Great Smoky Mountains. The North Carolina Piedmont examples of this association are only montane transition areas, such as the Sauratown Mountains and Hanging Rock. In West Virginia, this association is floristically intermediate between *Quercus prinus - Carya ovata - Quercus rubra / Acer saccharum* Forest (CEGL007268) and the more xeric *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271), and some stands are difficult to distinguish. It lacks the abundance of *Acer saccharum* (sugar maple) of the former and the abundance of ericaceous shrubs of the latter and has higher abundance of *Liriodendron tulipifera* (tuliptree) than either.

Similar Associations:

- *Acer rubrum* var. *rubrum - Betula (alleghaniensis, lenta) - Magnolia fraseri / (Rhododendron maximum, Kalmia latifolia)* Forest (CEGL008558).
- *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271)--is similar but features a well-developed ericaceous shrub layer.
- *Quercus alba - Quercus (rubra, prinus) / Rhododendron calendulaceum - Kalmia latifolia - (Gaylussacia ursina)* Forest (CEGL007230)--occurs at higher elevations and has a stronger white oak component.
- *Quercus prinus - Carya ovata - Quercus rubra / Acer saccharum* Forest (CEGL007268)--is similar but characterized by *Acer saccharum* as an important subcanopy (or canopy) tree.
- *Quercus prinus - Quercus rubra / Hamamelis virginiana* Forest (CEGL006057).
- *Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest (CEGL006286).
- *Quercus rubra - Quercus prinus - Magnolia (acuminata, fraseri) / Acer pensylvanicum* Forest [Provisional] (CEGL004817).

Related Concepts:

- *Quercus montana - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (Fleming et al. 2006) =
- *Quercus prinus - Quercus rubra - (Quercus alba) - Liriodendron tulipifera - Acer rubrum / Parthenocissus quinquefolia* forest (Vanderhorst 2001b) B
- Chestnut Oak Forest (Herb Subtype) (Schafale 1998b) ?
- IA6h. Montane Oak - Hickory Forest (Allard 1990) B
- Montane Mixed Oak / Oak - Hickory Forest (Fleming and Coulling 2001) B
- Oak - Chestnut - Hickory Forest (Ambrose 1990a) B

SOURCES

Description Authors: K. D. Patterson, mod. T. Govus, R. White, S. C. Gawler, G. P. Fleming.

References: Allard 1990, Ambrose 1990a, Fleming and Coulling 2001, Fleming and Moorhead 2000, Fleming and Patterson 2009a, Fleming et al. 2006, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Simon pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2010.


Plot GARI.44. Oak - Hickory Forest.

COMMON NAME (PARK-SPECIFIC): OAK / GREAT LAUREL FOREST

SYNONYMS

USNVC English Name:	**Chestnut Oak - Northern Red Oak / Great Laurel / Beetleweed Forest**
USNVC Scientific Name:	***Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest**
USNVC Identifier:	**CEGL006286**

LOCAL INFORMATION

Environmental Description: This association occurs on sandstone colluvium on gorge slopes with relatively warm aspects. Mean solar exposure in mapped polygons is relatively high but with a high standard deviation. It can occur on any aspect but most sites have southerly to westerly aspects. Slopes in mapped polygons range from 2 to 50 degrees (mean = 25.1). Elevations in mapped polygons range from 214 to 596 m (mean = 426.8). Bedrock geology is mapped as sandstones of the New River formation of the Pottsville group, and surficial geology noted in plots is exclusively sandstone. Unvegetated ground cover in plots is dominated by litter and large rocks. Soils in plots are described as well- to rapidly-drained, dry to somewhat moist sandy loam and sandy clay loam. Soils of some sites may be classified as folists, characterized by deep organic horizons (duff) over bouldery colluvium. Soils test very strongly to extremely acidic (mean pH = 4.20) with relatively high levels of estimated N release and Al, and relatively low levels of B, Ca, Cu, Mg, Mn, Na, P and Zn compared to average values from all plots in the park. Most stands of this association are imbedded in the matrix Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543). Adjacent patches of deciduous forest which lack high cover by *Rhododendron maximum* (great laurel) include Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222) and Oak - Hickory Forest (CEGL007267).

Vegetation Description: This association represents forests with mostly deciduous canopies dominated by oaks growing over a dense tall-shrub layer dominated by *Rhododendron maximum* (great laurel). Canopies are relatively tall (>20 m) with cover in plots ranging from 40 to 80%. Codominant trees in the canopy include *Quercus prinus* (chestnut oak) (constant in plots), *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Betula lenta* (sweet birch), and *Acer rubrum* (red maple). Additional trees with lower constancy and cover in the canopy and subcanopy include *Tsuga canadensis* (eastern hemlock), *Oxydendrum arboreum* (sourwood), *Fagus grandifolia* (American beech), and *Nyssa sylvatica* (blackgum). Cover in the tall-shrub layer of plots ranges from 20 to 70%, dominated by the evergreen *Rhododendron maximum* (great laurel). Additional shrubs and vines include *Smilax rotundifolia* (roundleaf greenbrier), *Ilex opaca* var. *opaca* (American holly), *Hamamelis virginiana* (American witchhazel), and *Kalmia latifolia* (mountain laurel). The herb layer has low cover (5% or less in plots) and diversity. The most common herbs are *Polystichum acrostichoides* (Christmas fern), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Solidago caesia* (wreath goldenrod), *Mitchella repens* (partridgeberry), *Eurybia divaricata* (white wood aster), *Dryopteris marginalis* (marginal woodfern), *Dioscorea quaternata* (fourleaf yam), and *Chimaphila maculata* (striped prince's pine). Vascular plant species richness in plots ranges from 12 to 49 taxa (mean = 30.1) Nonvascular cover in plots ranges from 0 to 30%, dominated by mosses. Common mosses include *Thuidium delicatulum* (delicate thuidium moss), *Leucobryum glaucum* (leucobryum moss), *Dicranum fulvum*

(dicranum moss), *Leucobryum albidum* (leucobryum moss), and *Hypnum imponens* (hypnum moss).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	.	.	[not crosswalked]	.

Local Range: This association is scattered on gorge slopes throughout the park. It is most abundant on river right (on the right looking downstream) in the eastern two-thirds of the park.
Classification Comments: The nominal evergreen herb *Galax urceolata* (beetleweed) was not found in this community at Gauley River although habitat seems appropriate. The park is close to the northern limits of this species' range; it is present but not common in the park. Stands similar to this association but with significant cover by *Tsuga canadensis* (eastern hemlock) in the canopy layers are classified as Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543).
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Seven plots were sampled: GARI.43, GARI.55, GARI.80, GARI.105, GARI.121, GARI.152, and GARI.201.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus prinus - Quercus rubra* Forest Alliance (A.250)
Alliance (English name)	Chestnut Oak - Northern Red Oak Forest Alliance
Association	*Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest
Association (English name)	Chestnut Oak - Northern Red Oak / Great Laurel / Beetleweed Forest
Ecological System(s):	Southern Appalachian Oak Forest (CES202.886).

GLOBAL DESCRIPTION

Concept Summary: This forest is known from protected, usually steep slopes in the Southern Blue Ridge and ranges into adjacent areas of the upper Piedmont to the east and the Cumberlands and Southern Ridge and Valley to the west. In the southern portion of its range (Southern Blue Ridge), it usually occurs on north-facing slopes, while in the northern part of its range (the Cumberlands in West Virginia), most sites have southerly to westerly aspects. This is typically a midslope to lower slope type, but it can be found on upper slopes in a more sheltered position. This forest is found at elevations between 760 and 1220 m (2500–4000 ft) in the Southern Blue Ridge and at somewhat lower elevations (200–600 m) in the Cumberland Plateau. Canopies in these forests are dominated by *Quercus prinus* (chestnut oak), usually with lesser amounts of *Quercus rubra* (northern red oak) and/or *Acer rubrum* (red maple), and always occurring over a dense, very tall shrub stratum (2–6 m) of *Rhododendron maximum* (great laurel). In some examples, this community may also be codominated or dominated by *Quercus velutina* (black

oak), *Quercus alba* (white oak), or *Betula lenta* (sweet birch). Additional trees with lower constancy and cover in the canopy and subcanopy include *Tsuga canadensis* (eastern hemlock), *Oxydendrum arboreum* (sourwood), *Fagus grandifolia* (American beech), and *Nyssa sylvatica* (blackgum). On some sites, *Tsuga canadensis* (eastern hemlock) may have dense understory regeneration. In some areas of the Southern Blue Ridge, *Rhododendron minus* (piedmont rhododendron) may dominate the shrub layer. Other common shrubs can include *Gaylussacia ursina* (bear huckleberry) (in the Southern Blue Ridge), *Kalmia latifolia* (mountain laurel), *Smilax rotundifolia* (roundleaf greenbrier), *Ilex opaca* var. *opaca* (American holly), and/or *Hamamelis virginiana* (American witchhazel). Herbs are sparse. The ground cover is dominated by leaf litter, but *Galax urceolata* (beetleweed) is found in most occurrences except at the northern limit of this type's range in West Virginia. Other herb species that can be typical include *Chimaphila maculata* (striped prince's pine), *Goodyera pubescens* (downy rattlesnake plantain), *Polystichum acrostichoides* (Christmas fern), *Maianthemum racemosum* (feathery false lily of the valley), *Solidago caesia* (wreath goldenrod), *Mitchella repens* (partridgeberry), *Eurybia divaricata* (white wood aster), *Dryopteris marginalis* (marginal woodfern), and *Dioscorea quaternata* (fourleaf yam). Some examples may have sparse (woodland-like) canopies and occur in association with rock outcroppings. Vascular plant species richness in seven 400-square-meter West Virginia plots ranges from 12 to 49 taxa (mean = 30.1).

Environmental Description: This forest is known from protected, usually steep slopes in the Southern Blue Ridge and ranges into adjacent areas of the upper Piedmont to the east and the Cumberlands and Southern Ridge and Valley to the west. In the southern portion of its range (Southern Blue Ridge), it usually occurs on north-facing slopes, while in the northern part of its range (the Cumberlands in WV), most sites have southerly to westerly aspects. This is typically a midslope to lower slope type, but it can be found on upper slopes in a more sheltered position. This forest is found at elevations between 760 and 1220 m (2500–4000 ft) in the Southern Blue Ridge and at somewhat lower elevations (200–600 m) in the Cumberland Plateau. Soils in WV plots are described as well- to rapidly-drained, dry to somewhat moist sandy loam and sandy clay loam that test very strongly to extremely acidic (mean pH = 4.20). Soils of some sites may be classified as folists, characterized by deep organic horizons (duff) over bouldery colluvium.

Vegetation Description: Canopies in these forests are dominated by *Quercus prinus* (chestnut oak), usually with lesser amounts of *Quercus rubra* (northern red oak) and/or *Acer rubrum* (red maple), and always occurring over a dense, very tall shrub stratum (2–6 m) of *Rhododendron maximum* (great laurel). In some examples, this community may also be codominated or dominated by *Quercus velutina* (black oak), *Quercus alba* (white oak), or *Betula lenta* (sweet birch). Additional trees with lower constancy and cover in the canopy and subcanopy include *Tsuga canadensis* (eastern hemlock), *Oxydendrum arboreum* (sourwood), *Fagus grandifolia* (American beech), and *Nyssa sylvatica* (blackgum). On some sites, *Tsuga canadensis* (eastern hemlock) may have dense understory regeneration. In some areas of the Southern Blue Ridge, *Rhododendron minus* (piedmont rhododendron) may dominate the shrub layer. Other common shrubs can include *Gaylussacia ursina* (bear huckleberry) (in the Southern Blue Ridge), *Kalmia latifolia* (mountain laurel), *Smilax rotundifolia* (roundleaf greenbrier), *Ilex opaca* var. *opaca* (American holly), and/or *Hamamelis virginiana* (American witchhazel). Herbs are sparse. The ground cover is dominated by leaf litter, but *Galax urceolata* (beetleweed) is found in most occurrences except at the northern limit of this type's range in West Virginia. Other herb species that can be typical include *Chimaphila maculata* (striped prince's pine), *Goodyera pubescens* (downy rattlesnake plantain), *Polystichum acrostichoides* (Christmas fern), *Maianthemum*

racemosum (feathery false lily of the valley), *Solidago caesia* (wreath goldenrod), *Mitchella repens* (partridgeberry), *Eurybia divaricata* (white wood aster), *Dryopteris marginalis* (marginal woodfern), and *Dioscorea quaternata* (fourleaf yam). Some examples may have sparse (woodland-like) canopies and occur in association with rock outcroppings. Vascular plant species richness in seven 400-square-meter WV plots ranges from 12 to 49 taxa (mean = 30.1).

In the Great Smoky Mountains, this community is found consistently as a transitional band of vegetation, downslope from drier *Quercus prinus* (chestnut oak) ridgetop forests, *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271), and grading into acidic cove forests, *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543), on the steep ravines below. At Cumberland Gap National Historical Park and the Gauley River National Recreation Area, it can grade into mixed mesophytic forests (CEGL005222) as well.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak)
Tall shrub/sapling	Broad-leaved evergreen tree	*Rhododendron maximum* (great laurel)

Characteristic Species: *Chimaphila maculata* (striped prince's pine), *Galax urceolata* (beetleweed), *Polystichum acrostichoides* (Christmas fern), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Rhododendron maximum* (great laurel).

Other Noteworthy Species:

Species	GRank	Type	Note
Trillium rugelii (illscented wakerobin)	G3	plant	
Tsuga caroliniana (Carolina hemlock)	G3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge of northeastern Georgia, northwestern South Carolina, north through eastern Tennessee, western North Carolina, and southwestern Virginia. It extends into the Cumberlands and Southern Ridge and Valley of Kentucky, Virginia and West Virginia. Its range also extends into the upper Piedmont of North Carolina.

States/Provinces: GA, KY, NC, SC, TN, VA:S3?, WV.

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Appalachian Trail, Blue Ridge Parkway, Carl Sandburg Home, Cumberland Gap, Gauley River, Great Smoky Mountains); USFS (Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Cherokee, Jefferson, Nantahala, Sumter, Sumter (Mountains), Sumter (Piedmont)).

CONSERVATION STATUS

Rank: G4 (22-Feb-2010).

Reasons: This community is uncommon, but not rare, throughout most of its range. As currently defined, it is a regional endemic, found only in the Southern Blue Ridge and adjacent regions of the upper Piedmont and Cumberlands and Southern Ridge and Valley . This community is often overlooked or not distinguished separately in inventories; thus, it is more common than the number of documented occurrences suggests.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This association is more protected and more mesic than *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271). It occurs at lower elevations and on more protected topographic positions than *Quercus rubra / (Kalmia latifolia, Rhododendron catawbiense* (Catawba rosebay), *Rhododendron maximum) / Galax urceolata* Forest (CEGL007299). It is much less diverse than *Quercus prinus - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (CEGL007267), lacking the diverse herbaceous and woody components found in that association. Stands similar to this association but with significant cover by *Tsuga canadensis* (eastern hemlock) in the canopy layers are classified as *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543).

Similar Associations:

- *Acer rubrum* var. *rubrum - Betula (alleghaniensis, lenta) - Magnolia fraseri / (Rhododendron maximum, Kalmia latifolia)* Forest (CEGL008558).
- *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543).
- *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271).
- *Quercus prinus - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (CEGL007267).
- *Quercus prinus / Rhododendron catawbiense - Kalmia latifolia* Forest (CEGL008524)--is mostly of the Central Appalachians and only peripherally in the northern portion of the Southern Blue Ridge; occupies drier sites and is characterized by a dense *Rhododendron catawbiense* shrub layer.
- *Quercus rubra / (Kalmia latifolia, Rhododendron catawbiense, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299).

Related Concepts:

- *Quercus montana - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest (Fleming et al. 2006) =
- Chestnut Oak Forest (Rhododendron Subtype) (Schafale 1998b) ?
- IA6d. Chestnut Oak Slope and Ridge Forest (Allard 1990) B
- Oak / Heath Forest (Fleming and Coulling 2001) B

SOURCES

Description Authors: K. D. Patterson, mod. R. White and S. C. Gawler.

References: Allard 1990, Fleming and Coulling 2001, Fleming and Patterson 2009a, Fleming et al. 2006, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Simon pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst et al. 2010.


Plot GARI.201. Oak / Great Laurel Forest.

COMMON NAME (PARK-SPECIFIC): OAK - HICKORY FLOODPLAIN FOREST

SYNONYMS

USNVC English Name: **(Northern Red Oak, Black Oak, White Oak) / American hornbeam - (Mountain Silverbell) / Feathery False Lily-of-the-valley Forest**

USNVC Scientific Name: ***Quercus (rubra, velutina, alba) / Carpinus caroliniana - (Halesia tetraptera) / Maianthemum racemosum* Forest**

USNVC Identifier: **CEGL006462**

LOCAL INFORMATION

Environmental Description: This association occurs in a few small patches on upper floodplains subject to infrequent, low-energy flooding. Historical extent of this community has probably been reduced by construction of railroads along the river and by reduction of peak flows since construction of Summersville Dam. Slopes in mapped polygons range from 3 to 26 degrees (mean = 22.5). Elevations in mapped polygons range from 241 to 351 m (mean = 271.2). Sites have fluvial microtopography of levees and swales formed from sandy alluvium. Unvegetated ground cover in the one plot sampled is dominated by litter. Soil in the plot is described as well-drained, somewhat moist sand with some evidence of A horizon development. Soil from one plot tested extremely acidic (pH = 4.1) with relatively high levels of S, Fe, and P, and relatively low levels of total exchange capacity, organic matter, estimated N release, Al, B, Ca, Cu, K, Mg, Mn, Na, and Zn compared to average values from all plots in the park. Adjacent vegetation on floodplains includes Eastern Hemlock Floodplain Forest (CEGL006620), (Virginia, Pitch) Pine Floodplain Forest (CEGL006624), American Sycamore - River Birch Riverscour Woodland (CEGL003725), and Riverscour Shrub Prairie (CEGL006623).

Vegetation Description: This association is a deciduous floodplain forest dominated by species of *Quercus* (oak) and *Carya* (hickory). The canopy of the one plot sampled is tall (30 m) with 70% cover. Canopy trees in the plot include (in decreasing order of cover) *Quercus velutina* (black oak), *Liriodendron tulipifera* (tuliptree), *Quercus alba* (white oak), *Carya alba* (mockernut hickory), and *Sassafras albidum* (sassafras). Cover in the subcanopy of the plot is 60%. In addition to the canopy species, the subcanopy includes *Magnolia acuminata* (cucumber-tree), *Magnolia fraseri* (mountain magnolia), *Magnolia tripetala* (umbrella-tree), and *Oxydendrum arboreum* (sourwood). The tall-shrub layer has 40% cover and includes *Magnolia tripetala* (umbrella-tree), *Asimina triloba* (pawpaw), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), and *Ilex opaca* var. *opaca* (American holly). The short-shrub layer has 10% cover and includes *Xanthorhiza simplicissima* (yellowroot), *Chionanthus virginicus* (white fringetree), *Euonymus americanus* (strawberry bush), *Hamamelis virginiana* (American witchhazel), and *Smilax rotundifolia* (roundleaf greenbrier). The herb layer has 40% cover, which is dominated by the rhizomatous fern *Thelypteris noveboracensis* (New York fern). Additional herbs in the plot include *Hexastylis virginica* (Virginia heartleaf), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), *Brachyelytrum erectum* (bearded shorthusk), *Conopholis americana* (American squawroot), *Osmunda cinnamomea* (cinnamon fern), *Parthenocissus quinquefolia* (Virginia creeper), *Polygonatum biflorum* (smooth Solomon's seal), and *Sanguinaria canadensis* (bloodroot). Vascular plant species richness in the plot is 44 taxa.

Most Abundant Species: Information not available.

Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association occurs in a few small patches along the middle section of the Gauley River in the park.
Classification Comments: This association occurs in very small patches and is not well-developed at Gauley River, but is recognized based on experience with similar vegetation along other West Virginia rivers. The parenthetical nominal *Halesia tetraptera* (mountain silverbell) and the herb *Hydrastis canadensis* (goldenseal), which characterize stands of this association at New River, do not occur in stands at Gauley River. This association differs from upland occurrences of Oak - Hickory Forest (CEGL007267) by the presence of species which are characteristic of floodplains; at Gauley River, these include *Carpinus caroliniana* ssp. *virginiana* (American hornbeam) and *Xanthorhiza simplicissima* (yellowroot).
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: One plot was sampled: GARI.89.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)
Alliance	*Acer saccharum - Carya cordiformis* Temporarily Flooded Forest Alliance (A.302)
Alliance (English name)	Sugar Maple - Bitternut Hickory Temporarily Flooded Forest Alliance
Association	*Quercus (rubra, velutina, alba) / Carpinus caroliniana - (Halesia tetraptera) / Maianthemum racemosum* Forest
Association (English name)	(Northern Red Oak, Black Oak, White Oak) / American hornbeam - (Mountain Silverbell) / Feathery False Lily-of-the-valley Forest
Ecological System(s):	South-Central Interior Large Floodplain (CES202.705).

GLOBAL DESCRIPTION

Concept Summary: This association is a closed-canopy to somewhat open-canopy deciduous floodplain forest on the highest positions of river floodplains. These alluvial terraces are infrequently flooded and some are possibly no longer flooded. Low frequency and low energy of flooding is evidenced by the development of litter layers and organic-enriched soil horizons. Soils are well-drained sands and sandy loams, and soil moisture regime may be somewhat dry. The soils are slightly to moderately acidic and have relatively high cation levels. Slopes range from level to steep. The canopy is frequently composed of very large-diameter, tall trees, with species more typical of uplands. Dominant trees in the canopy include *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Quercus alba* (white oak), *Liriodendron tulipifera* (tuliptree), and *Acer saccharum* (sugar maple). Additional trees which may occur in the canopy and subcanopy include *Acer rubrum* (red maple), *Carya alba* (mockernut hickory), *Carya cordiformis* (bitternut hickory), *Carya ovata* (shagbark hickory), *Fagus grandifolia* (American beech), *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), *Magnolia acuminata*

(cucumber-tree), *Magnolia tripetala* (umbrella-tree), *Nyssa sylvatica* (blackgum), *Platanus occidentalis* (American sycamore), *Prunus serotina* var. *serotina* (black cherry), and *Ulmus americana* (American elm). The small tree *Halesia tetraptera* (mountain silverbell) is dominant in some areas as a well-developed tall-shrub layer and may extend into the tree subcanopy; *Sassafras albidum* (sassafras) may also occur as a small tree. Additional shrubs include *Carpinus caroliniana* (American hornbeam), *Dirca palustris* (eastern leatherwood), *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush), *Smilax rotundifolia* (roundleaf greenbrier), *Magnolia tripetala* (umbrella-tree), *Asimina triloba* (pawpaw), and *Viburnum prunifolium* (blackhaw). Low shrubs may be present, though typically sparse, and include *Xanthorhiza simplicissima* (yellowroot), *Chionanthus virginicus* (white fringetree), *Euonymus americanus* (strawberry bush), *Hamamelis virginiana* (American witchhazel), and *Smilax rotundifolia* (roundleaf greenbrier). Characteristic herbs include *Ageratina altissima* (white snakeroot), *Amphicarpaea bracteata* (American hogpeanut), *Arisaema triphyllum* (Jack in the pulpit), *Cynoglossum virginianum* (wild comfrey), *Dichanthelium boscii* (Bosc's panicgrass), *Eurybia divaricata* (white wood aster), *Galium circaezans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Hexastylis virginica* (Virginia heartleaf), *Hydrastis canadensis* (goldenseal), *Maianthemum racemosum* (feathery false lily of the valley), *Packera aurea* (golden ragwort), *Polygonatum biflorum* (smooth Solomon's seal), *Sanguinaria canadensis* (bloodroot), *Sedum ternatum* (woodland stonecrop), *Thelypteris noveboracensis* (New York fern), and *Verbesina alternifolia* (wingstem).

Environmental Description: This association occurs in small patches on the highest positions of river floodplains which are infrequently flooded and possibly on alluvial terraces which are no longer flooded. The largest patches occur on large point bars which have developed along inside bends of large meanders. Evidence of flooding includes fluvial topography, accumulations of rocks on the upstream side of tree bases, and some flotsam. Sites have fluvial microtopography of levees and swales formed from sandy alluvium. Low frequency and low energy of flooding is evidenced by the development of litter layers and organic-enriched soil horizons. Soils are stone-free or somewhat stony, moderately well- to well-drained sands and sandy loams derived from alluvium, and soil moisture regime may be somewhat dry. Soil chemistry analyzed from six plots indicates slightly acidic soils (mean pH = 5.8 at New River and 5.0 at Bluestone) and relatively high levels of some nutrients (Ca, Mg, Zn) and relatively low levels of organic matter compared to soils of most upland forests in the area. Soil from the one sampled plot at Gauley River is considerably more acidic (pH=4.1). Slopes range from level to steep. Elevations of mapped stands range from 247 to 506 m.

Vegetation Description: This association is a closed-canopy to somewhat open-canopy deciduous floodplain forest dominated by tree species more typical of uplands. Many of the stands are composed of very large-diameter, tall trees. Dominant trees in the canopy include *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Quercus alba* (white oak), *Liriodendron tulipifera* (tuliptree), and *Acer saccharum* (sugar maple). Additional trees which may occur in the canopy and subcanopy include *Acer rubrum* (red maple), *Carya alba* (mockernut hickory), *Carya cordiformis* (bitternut hickory), *Carya ovata* (shagbark hickory), *Fagus grandifolia* (American beech), *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), *Magnolia acuminata* (cucumber-tree), *Magnolia tripetala* (umbrella-tree), *Nyssa sylvatica* (blackgum), *Platanus occidentalis* (American sycamore), *Prunus serotina* var. *serotina* (black cherry), and *Ulmus americana* (American elm). The small tree *Halesia tetraptera* (mountain silverbell) is dominant in some areas as a well-developed tall-shrub layer and may

extend into the tree subcanopy; *Sassafras albidum* (sassafras) may also occur as a small tree. Additional shrubs include *Carpinus caroliniana* (American hornbeam), *Dirca palustris* (eastern leatherwood), *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush), *Smilax rotundifolia* (roundleaf greenbrier), *Magnolia tripetala* (umbrella-tree), *Asimina triloba* (pawpaw), and *Viburnum prunifolium* (blackhaw). Low shrubs may be present, though typically sparse, and include *Xanthorhiza simplicissima* (yellowroot), *Chionanthus virginicus* (white fringetree), *Euonymus americanus* (strawberry bush), *Hamamelis virginiana* (American witchhazel), and *Smilax rotundifolia* (roundleaf greenbrier). Characteristic herbs include *Ageratina altissima* (white snakeroot), *Amphicarpaea bracteata* (American hogpeanut), *Arisaema triphyllum* (Jack in the pulpit), *Cynoglossum virginianum* (wild comfrey), *Dichanthelium boscii* (Bosc's panicgrass), *Eurybia divaricata* (white wood aster), *Galium circaezans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Hexastylis virginica* (Virginia heartleaf), *Hydrastis canadensis* (goldenseal), *Maianthemum racemosum* (feathery false lily of the valley), *Packera aurea* (golden ragwort), *Polygonatum biflorum* (smooth Solomon's seal), *Sanguinaria canadensis* (bloodroot), *Sedum ternatum* (woodland stonecrop), *Thelypteris noveboracensis* (New York fern), and *Verbesina alternifolia* (wingstem). Vascular plant species richness in the eight 400-square-meter sampled plots ranges from 16 to 79 (mean at New River = 32; mean at Bluestone = 69; Gauley = 44).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
		Liriodendron tulipifera (tuliptree)
		Quercus alba (white oak)
		Quercus rubra (northern red oak)
		Quercus velutina (black oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Halesia tetraptera* (mountain silverbell)
Herb (field)	Fern or fern ally	*Thelypteris noveboracensis* (New York fern)

Characteristic Species: *Ageratina altissima* (white snakeroot), *Arisaema triphyllum* (Jack in the pulpit), *Carpinus caroliniana* (American hornbeam), *Carya ovata* (shagbark hickory), *Cynoglossum virginianum* (wild comfrey), *Dichanthelium boscii* (Bosc's panicgrass), *Dirca palustris* (eastern leatherwood), *Fagus grandifolia* (American beech), *Galium circaezans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Halesia tetraptera* (mountain silverbell), *Hamamelis virginiana* (American witchhazel), *Hydrastis canadensis* (goldenseal), *Lindera benzoin* (northern spicebush), *Magnolia acuminata* (cucumber-tree), *Magnolia tripetala* (umbrella-tree), *Maianthemum racemosum* (feathery false lily of the valley), *Nyssa sylvatica* (blackgum), *Packera aurea* (golden ragwort), *Parthenocissus quinquefolia* (Virginia creeper), *Xanthorhiza simplicissima* (yellowroot).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association is currently known only from West Virginia along the New, Bluestone, and Gauley rivers.

States/Provinces: WV.

Federal Lands: NPS (Bluestone, Gauley River, New River Gorge).

CONSERVATION STATUS

Rank: GNR (5-Jun-2006).

Reasons: More information is needed to determine a global rank. This association is likely to have been reduced from its original extent by clearing for agriculture, transportation, or houses. At Gauley River, the historical extent of this community has probably been reduced by construction of railroads along the river and by reduction of peak flows since construction of Summersville Dam.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 3 - Weak.
Comments: This association has canopy composition similar to *Quercus prinus - (Quercus rubra) - Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (CEGL007267), but it is differentiated by its occurrence on floodplains and by the abundance of *Halesia tetraptera* (mountain silverbell) and other mesophytic species in the understory.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES
Description Authors: J. P. Vanderhorst, mod. S. C. Gawler.
References: Eastern Ecology Working Group n.d., Vanderhorst et al. 2007, Vanderhorst et al. 2008, Vanderhorst et al. 2010.

Plot GARI.89. Oak - Hickory Floodplain Forest.

COMMON NAME (PARK-SPECIFIC): AMERICAN SYCAMORE - TULIPTREE - SWEETGUM FLOODPLAIN FOREST

SYNONYMS

USNVC English Name: **Sweetgum - Tuliptree / Northern Spicebush / Jack-in-the-Pulpit Forest**

USNVC Scientific Name: ***Liquidambar styraciflua - Liriodendron tulipifera / Lindera benzoin / Arisaema triphyllum* Forest**

USNVC Identifier: **CEGL004418**

LOCAL INFORMATION

Environmental Description: This association occurs in a few small patches on river floodplains. Most patches are along slower reaches of the lower Gauley River in the park where broader floodplains occur on point bars, alluvial fans, and islands. Slopes in mapped polygons range from 0.6 to 31.4 degrees (mean = 6.9). Elevations in mapped polygons range from 208 to 319 m (mean = 215.6). Evidence of infrequent flooding includes fluvial topography, mixed exposed sand, light flotsam and leaf litter accumulations, and lack of soil horizon development. Soils in plots are described as temporarily flooded, well-drained sand. Soils test slightly to strongly acidic (mean pH = 5.85) with relatively high levels of Cu and Mg, and relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, B, K, and P compared to average values from all plots in the park. Adjacent vegetation on floodplains includes Eastern Hemlock Floodplain Forest (CEGL006620), in less frequently flooded positions, and American Sycamore - River Birch Riverscour Woodland (CEGL003725) and Riverscour Shrub Prairie (CEGL006623) in more frequently flooded positions.

Vegetation Description: This association is a deciduous floodplain forest with tall (>20 m), mostly closed canopies. The typical codominant canopy trees are *Platanus occidentalis* (American sycamore) and *Liriodendron tulipifera* (tuliptree); *Liquidambar styraciflua* (sweetgum) is a characteristic associate. Additional trees include *Betula nigra* (river birch), *Carya cordiformis* (bitternut hickory), *Acer rubrum* (red maple), and *Ulmus* (elm) spp. *Carpinus caroliniana* ssp. *virginiana* (American hornbeam) usually dominates the subcanopy and tall-shrub layers. Additional shrubs and vines in plots include *Asimina triloba* (pawpaw), *Lindera benzoin* (northern spicebush), *Xanthorhiza simplicissima* (yellowroot), *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (eastern poison ivy). The herb layer has moderate cover and diversity. Common native herbs include *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), *Packera aurea* (golden ragwort), *Dichanthelium clandestinum* (deertongue), *Symphyotrichum prenanthoides* (crookedstem aster), *Eurybia divaricata* (white wood aster), *Collinsonia canadensis* (richweed), *Viola striata* (striped cream violet), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), *Polystichum acrostichoides* (Christmas fern), *Polygonatum pubescens* (hairy Solomon's seal), *Deparia acrostichoides* (silver false spleenwort), and *Poa alsodes* (grove bluegrass). The exotics *Rosa multiflora* (multiflora rose), *Microstegium vimineum* (Nepalese browntop), and *Glechoma hederacea* (ground ivy) often invade this community. Vascular plant species richness in plots ranges from 38 to 55 taxa (mean = 45.25). Cover by nonvascular species is usually sparse.

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	.	.	[not crosswalked]	.

Local Range: This association occurs in a few small patches along the Gauley River, mostly towards the western end of the park.
Classification Comments: This association is distinguished from other floodplain forest associations in West Virginia by having an abundance of *Liquidambar styraciflua* (sweetgum) in the canopy or subcanopy. In West Virginia, this tree is confined to the low to middle elevations of the Ohio River drainage in the southwestern part of the state and is lacking from similar floodplain forests at higher elevations and in the Ridge and Valley in the eastern part of the state.
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Four plots were sampled: GARI.124, GARI.125, GARI.207, and GARI.214.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)
Alliance	*Liquidambar styraciflua - (Liriodendron tulipifera, Acer rubrum)* Temporarily Flooded Forest Alliance (A.287)
Alliance (English name)	Sweetgum - (Tuliptree, Red Maple) Temporarily Flooded Forest Alliance
Association	*Liquidambar styraciflua - Liriodendron tulipifera / Lindera benzoin / Arisaema triphyllum* Forest
Association (English name)	Sweetgum - Tuliptree / Northern Spicebush / Jack-in-the-Pulpit Forest
Ecological System(s):	Northern Atlantic Coastal Plain Stream and River (CES203.070). Southern Piedmont Small Floodplain and Riparian Forest (CES202.323).

GLOBAL DESCRIPTION

Concept Summary: These low-elevation forests develop along relatively acidic soils on small streams in the Coastal Plain of Maryland and Virginia, extending west across the Virginia and North Carolina Piedmont to the Cumberland Plateau and Ridge and Valley. The topographic features of floodplains can heavily influence the makeup of individual examples of this association. The canopy, subcanopy, shrub, and herbaceous layers often are well-developed. Dominant canopy species always include *Liquidambar styraciflua* (sweetgum) and *Liriodendron tulipifera* (tuliptree), while *Acer barbatum* (in the eastern part of the range), *Platanus occidentalis* (American sycamore), and *Acer rubrum* var. *rubrum* (red maple) may also make up significant amounts of the canopy. This community type exists as a continuum between two subtypes, i.e., the tuliptree subtype and the sweetgum subtype. In some examples, only one or the other dominates the canopy, but in many examples, both are equally dominant. Common species in the canopy and understory include *Ilex opaca* var. *opaca* (American holly), *Aesculus sylvatica* (painted buckeye), *Betula nigra* (river birch), *Carpinus caroliniana* ssp. *caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Carya cordiformis* (bitternut hickory), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Halesia tetraptera* var. *tetraptera* (mountain silverbell), *Juglans nigra* (black walnut), *Juniperus virginiana* var. *virginiana* (eastern red-cedar), *Morus rubra* var. *rubra* (red mulberry),

Nyssa sylvatica (blackgum), *Ostrya virginiana* var. *virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Pinus echinata* (shortleaf pine), *Prunus serotina* var. *serotina* (black cherry), *Quercus alba* (white oak), *Quercus rubra* var. *rubra* (northern red oak), *Ulmus rubra* (slippery elm), *Ulmus americana* (American elm), and *Ulmus alata* (winged elm). *Euonymus americanus* (strawberry bush), *Asimina triloba* (pawpaw), *Lindera benzoin* var. *benzoin* (northern spicebush), and *Corylus americana* (American hazelnut) are common in the shrub layer. The herbaceous layer is species-rich and often has good sedge development. The exotics *Microstegium vimineum* (Nepalese browntop), *Glechoma hederacea* (ground ivy), *Rosa multiflora* (multiflora rose), *Ligustrum sinense* (Chinese privet), and *Lonicera japonica* (Japanese honeysuckle) are common in this community.

Environmental Description: These forests develop along small streams or in small patches on river floodplains. Soils are relatively acidic and relatively well-drained. Topographic differences from one floodplain to another, such as gradient and height above the creek, as well as floodplain microtopography (i.e., depositional landforms such as natural levees and sloughs) may influence the variation of vegetation within this association. However, in most floodplains supporting this type, the distinct alluvial landforms are poorly developed or occur at very small scales. At some sites, evidence of infrequent flooding includes fluvial topography, mixed exposed sand, light flotsam and leaf litter accumulations, and lack of soil horizon development.

Vegetation Description: The canopy, subcanopy, shrub, and herbaceous layers of stands of this association are often well-developed. Dominant canopy species always include *Liquidambar styraciflua* (sweetgum) and *Liriodendron tulipifera* (tuliptree), while *Acer barbatum* (southern sugar maple) (in the southern part of the range), *Platanus occidentalis* (American sycamore), and *Acer rubrum* var. *rubrum* (red maple) may also make up significant amounts of the canopy. This community type exists as a continuum between two subtypes, i.e., the tuliptree subtype and the sweetgum subtype. In some examples, only one or the other dominates the canopy. However, in many examples, both are equally dominant. Other common species in the canopy and understory include *Ilex opaca* var. *opaca* (American holly), *Aesculus sylvatica* (painted buckeye), *Carpinus caroliniana* ssp. *caroliniana* (American hornbeam), *Carya cordiformis* (bitternut hickory), *Cornus florida* (flowering dogwood), *Fagus grandifolia* (American beech), *Juglans nigra* (black walnut), *Betula nigra* (river birch), *Morus rubra* var. *rubra* (red mulberry), *Ostrya virginiana* var. *virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Pinus echinata* (shortleaf pine), *Prunus serotina* var. *serotina* (black cherry), *Quercus alba* (white oak), *Quercus rubra* var. *rubra* (northern red oak), *Ulmus rubra* (slippery elm), *Ulmus americana* (American elm), *Ulmus alata* (winged elm), *Juniperus virginiana* var. *virginiana* (eastern red-cedar), *Nyssa sylvatica* (blackgum), *Fraxinus americana* (white ash), *Halesia tetraptera* var. *tetraptera* (mountain silverbell), *Arundinaria gigantea* ssp. *gigantea* (giant cane), and *Fraxinus pennsylvanica* (green ash). *Euonymus americanus* (strawberry bush), *Lindera benzoin* var. *benzoin* (northern spicebush), and *Corylus americana* (American hazelnut) are common and dominant in the shrub layer. Other shrub species that may be present include *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum nudum* var. *nudum* (possumhaw), *Viburnum prunifolium* (blackhaw), *Viburnum rufidulum* (rusty blackhaw), *Hamamelis virginiana* (American witchhazel), *Asimina triloba* (pawpaw), and *Ilex decidua* (possum-haw), among others. On the most acidic sites of the Maryland Coastal Plain, *Clethra alnifolia* (coastal sweetpepperbush), *Vaccinium corymbosum* (highbush blueberry), and *Magnolia virginiana* (sweetbay) may be present. Vines are prominent and include *Vitis rotundifolia* (muscadine), *Apios americana* (groundnut), *Campsis radicans* (trumpet creeper), *Aristolochia macrophylla*

(pipevine), *Bignonia capreolata* (crossvine), *Dioscorea quaternata* (fourleaf yam), *Gelsemium sempervirens* (evening trumpetflower), *Parthenocissus quinquefolia* (Virginia creeper), *Passiflora lutea* (yellow passionflower), *Smilax bona-nox* (saw greenbrier), *Smilax glauca* (cat greenbrier), *Smilax hugeri* (Huger's carrionflower), *Smilax rotundifolia* (roundleaf greenbrier), and *Toxicodendron radicans* ssp. *radicans* (eastern poison ivy). The herbaceous layer is species-rich and often has good sedge development. Common species in this layer include *Thalictrum thalictroides* (rue-anemone), *Trillium cuneatum* (little sweet Betsy), *Arisaema triphyllum* (Jack in the pulpit), *Asplenium platyneuron* var. *platyneuron* (ebony spleenwort), *Botrychium virginianum* (rattlesnake fern), *Carex* (sedge) spp., *Carex impressinervia* (ravine sedge), *Carex striatula* (lined sedge), *Cinna arundinacea* (sweet woodreed), *Collinsonia canadensis* (richweed), *Deparia acrostichoides* (silver false spleenwort), *Dichanthelium clandestinum* (deertongue), *Elymus virginicus* (Virginia wildrye), *Eurybia divaricata* (white wood aster), *Galium circaezans* (licorice bedstraw), *Geum canadense* (white avens), *Medeola virginiana* (Indian cucumber), *Packera aurea* (golden ragwort), *Poa alsodes* (grove bluegrass), *Polygonatum pubescens* (hairy Solomon's seal), *Polystichum acrostichoides* (Christmas fern), *Rudbeckia laciniata* (cutleaf coneflower), *Scutellaria integrifolia* (helmet flower), *Symphyotrichum prenanthoides* (crookedstem aster), and *Viola striata* (striped cream violet). *Thelypteris noveboracensis* (New York fern) is a common patch-dominant in the northern part of the range and the Uwharrie Mountains of North Carolina. The exotics *Microstegium vimineum* (Nepalese browntop), *Glechoma hederacea* (ground ivy), *Rosa multiflora* (multiflora rose), *Ligustrum sinense* (Chinese privet), and *Lonicera japonica* (Japanese honeysuckle) are common in this community. Other exotics that colonize quickly in disturbed and fragmented versions of this association include *Wisteria sinensis* (Chinese wisteria), *Clematis* (leather flower) *terniflora*, *Hedera helix* (English ivy), and *Elaeagnus* (elaeagnus) sp.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Liquidambar styraciflua* (sweetgum) *Liriodendron tulipifera* (tuliptree)

Characteristic Species: *Arisaema triphyllum* (Jack in the pulpit), *Asplenium platyneuron* (ebony spleenwort), *Botrychium virginianum* (rattlesnake fern), *Campsis radicans* (trumpet creeper), *Carex striatula* (lined sedge), *Cinna arundinacea* (sweet woodreed), *Corylus americana* (American hazelnut), *Elymus virginicus* (Virginia wildrye), *Euonymus americanus* (strawberry bush), *Galium circaezans* (licorice bedstraw), *Geum canadense* (white avens), *Lindera benzoin* (northern spicebush), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Medeola virginiana* (Indian cucumber), *Polystichum acrostichoides* (Christmas fern), *Scutellaria integrifolia* (helmet flower), *Smilax rotundifolia* (roundleaf greenbrier), *Thalictrum thalictroides* (rue-anemone), *Toxicodendron radicans* (eastern poison ivy), *Trillium cuneatum* (little sweet Betsy).

Other Noteworthy Species:

Species	GRank	Type	Note
Carex impressinervia (ravine sedge)	G2	plant	globally imperiled
Carex kraliana (Kral's sedge)	-	plant	is evidently near the northern limit of its (primarily southeastern United States) range and is presently known from only two Maryland sites, has been found in this vegetation type at Thomas Stone NHS.

Species	GRank	Type	Note
Clematis terniflora (sweet autumn virginsbower)	-	plant	invasive exotic
Glechoma hederacea (ground ivy)	-	plant	invasive exotic
Hedera helix (English ivy)	-	plant	invasive exotic
Ligustrum sinense (Chinese privet)	-	plant	invasive exotic
Lonicera japonica (Japanese honeysuckle)	-	plant	invasive exotic
Microstegium vimineum (Nepalese browntop)	-	plant	invasive exotic
Rosa multiflora (multiflora rose)	-	plant	invasive exotic
Wisteria sinensis (Chinese wisteria)	-	plant	invasive exotic

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association is found in the Chesapeake Bay Lowlands, the Piedmont, and other low-elevation interior ecoregions (e.g., parts of the Cumberland Plateau and Ridge and Valley). It is defined as being absent from the Mid-Atlantic Coastal Plain of southeastern Virginia, the Carolinas, and Georgia. Its status in the Upper East Gulf Coastal Plain is unknown.
States/Provinces: DC, GA, MD, NC, SC?, TN, VA:S4, WV.
Federal Lands: DOD (Fort Belvoir); NPS (Chickamauga-Chattanooga, Colonial, Cowpens, Fredericksburg-Spotsylvania, Gauley River, Guilford Courthouse, Kennesaw Mountain, Kings Mountain, National Capital-East, Petersburg, Prince William, Richmond, Thomas Stone); USFS (Uwharrie).

CONSERVATION STATUS

Rank: G4 (15-Feb-2007).
Reasons: This community is widespread from the Coastal Plain of Maryland and Virginia through the Piedmont of Virginia and North Carolina to the Cumberland Plateau. Very few streams supporting this type have impoundments or diversions, and most are protected by wetland regulations. However, few, if any, pristine examples remain, and all are highly threatened by invasive exotic species that have colonized most of the remaining examples of this association.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 3 - Weak.
Comments: Low-quality occurrences of this type may look very similar to some occurrences of *Liquidambar styraciflua - (Liriodendron tulipifera)* Temporarily Flooded Forest (CEGL007330). The presence of higher quality patches of native herbs and stands of native shrubs such as *Lindera benzoin* (northern spicebush) is the best way to distinguish these two types. In addition, stands of CEGL007330 will generally be more even-aged and single species-dominated than this association (CEGL004418).
Similar Associations:

- *Betula nigra - Acer rubrum - (Liquidambar styraciflua, Platanus occidentalis)* Successional Forest (CEGL006976).
- *Liquidambar styraciflua - (Liriodendron tulipifera)* Temporarily Flooded Forest (CEGL007330)--occurs in the same habitat but is a highly impacted version of this forest that occurs on old farm fields and other second-growth areas.
- *Liquidambar styraciflua* Forest (CEGL007216).
- *Liriodendron tulipifera - Acer (rubrum, negundo) - (Platanus occidentalis) / Carpinus caroliniana / Polygonum virginianum* Forest (CEGL006492).

Related Concepts:

- *Liquidambar styraciflua - Liriodendron tulipifera / Lindera benzoin / Arisaema triphyllum* Forest (Fleming et al. 2006) =
- *Liquidambar styraciflua - Quercus palustris / Carpinus caroliniana / Carex intumescens* Forest (Meininger and McCarthy 1998) ?
- Coastal Plain / Piedmont Floodplain Forest (Fleming et al. 2006) B
- Maple-Gum Association of the Western Shore District (Shreve et al. 1910) B

SOURCES

Description Authors: R. K. Peet, mod. R. White, M. Pyne, G. P. Fleming, S. C. Gawler.

References: Fleming et al. 2001, Fleming et al. 2006, Meininger and McCarthy 1998, Naczi et al. 2002, Peet et al. unpubl. data 2002, Schafale and Weakley 1990, Shreve et al. 1910, Southeastern Ecology Working Group n.d., Vanderhorst et al. 2010.

Plot GARI.125. American Sycamore - Tuliptree - Sweetgum Floodplain Forest.

COMMON NAME (PARK-SPECIFIC): FOREST SEEP

SYNONYMS

USNVC English Name: **Red Maple - Blackgum / Common Winterberry - Black Highbush Blueberry / Cinnamon Fern Forest**
USNVC Scientific Name: ***Acer rubrum - Nyssa sylvatica / Ilex verticillata - Vaccinium fuscatum / Osmunda cinnamomea* Forest**
USNVC Identifier: **CEGL007853**

LOCAL INFORMATION

Environmental Description: This association occurs in small patches in headwater drainages on the plateaus. Presence of this community was often accurately predicted by the "wet flat" ecological land unit (ELU) derived from a topographic analysis of a digital elevation model for the park; wet flat is one of the rarest ELU types in the park. These sites are jurisdictional wetlands fed by seepage and possibly by occasional overbank flooding of small streams. There is often a small ephemeral stream channel running through or adjacent to the community. Slopes in mapped polygons range from 1 to 17 degrees (mean = 7.7). Elevations in mapped polygons range from 365 to 563 m (mean = 464). Bedrock geology is mapped as sandstone of the New River and Kanawha formations in the Pottsville group. Evidence of wetland hydrology includes crayfish chimneys, oxidized root channels, low soil chroma, and high water tables. Unvegetated ground cover is dominated by litter with significant exposed sand in some plots. Soils in plots are described as moderately well-drained to very poorly-drained, moist to semipermanently flooded loamy sand, sandy loam, silt loam, and sandy clay loam. Soils test very strongly to extremely acidic (mean pH = 4.27) with relatively low levels of total exchange capacity, organic matter, estimated N release, B, Ca, K, and Zn compared to average values from all plots in the park. These forest seeps are embedded in upland forest types, including Eastern Hemlock Plateau Forest (CEGL006304), Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222), and Successional Tuliptree Forest (CEGL007221).

Vegetation Description: This association represents wetland vegetation that has deciduous or mixed evergreen-deciduous forest or woodland physiognomy. Trees are usually rooted around the edges of the wetland or on hummocks, and there may be a canopy gap in the center of the stand. Tree canopies are tall (>20 m) with cover in plots ranging from 40 to 90%. Canopy trees include (in decreasing order of constancy in plots) *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Quercus alba* (white oak), *Ulmus rubra* (slippery elm), *Fraxinus americana* (white ash), and *Platanus occidentalis* (American sycamore). Additional tree species which are common in the subcanopy and shrub layers include *Tsuga canadensis* (eastern hemlock) and *Nyssa sylvatica* (blackgum). Cover in the shrub layers of plots ranges from 4 to 60%. Common shrub species include *Ilex opaca* var. *opaca* (American holly), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), *Asimina triloba* (pawpaw), *Lindera benzoin* (northern spicebush), *Euonymus americanus* (strawberry bush), and *Rosa multiflora* (multiflora rose). Cover in the herb layer of plots ranges from 10 to 90%. Common herbs include (in decreasing order of constancy) *Thelypteris noveboracensis* (New York fern), *Athyrium filix-femina* ssp. *angustum* (subarctic ladyfern), *Polystichum acrostichoides* (Christmas fern), *Eurybia divaricata* (white wood aster), *Viola cucullata* (marsh blue violet), *Mitchella repens* (partridgeberry), and *Chelone glabra* (white turtlehead). Additional herbs that indicate wetland conditions include *Onoclea sensibilis* (sensitive fern), *Leersia virginica* (whitegrass), *Boehmeria*

cylindrica (small-spike false nettle), *Osmunda cinnamomea* (cinnamon fern), *Lycopus virginicus* (Virginia water horehound), and *Glyceria striata* (fowl mannagrass). Vascular plant species richness in plots ranges from 18 to 72 taxa (mean = 42). Nonvascular cover in plots ranges from 0 to 20% and is dominated by mosses. Mosses identified in plots include *Thuidium delicatulum* (delicate thuidium moss), *Plagiomnium ciliare* (plagiomnium moss), *Plagiomnium ciliare* (plagiomnium moss), *Atrichum angustatum* (atrichum moss), *Aulacomnium palustre* (aulacomnium moss), *Leucobryum glaucum* (leucobryum moss), *Bryoandersonia illecebra* (bryoandersonia moss), *Polytrichum juniperinum* (juniper polytrichum moss), and *Sphagnum palustre* (prairie sphagnum).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	=	1	[gname]	Byers et al. 2007

Local Range: Information not available.
Classification Comments: Occurrences of this association at GARI are very small and have fewer wetland obligates compared to better developed examples at New River Gorge National River. West Virginia examples in general lack many of the southern species listed in the global description. At GARI, *Tsuga canadensis* (eastern hemlock) is often an important species in the subcanopy, reflecting the dominance of this species in the surrounding uplands.
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Eight plots were sampled: GARI.46, GARI.96, GARI.136, GARI.169, GARI.189, GARI.195, GARI.200, and GARI.215.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Saturated cold-deciduous forest (I.B.2.N.g.)
Alliance	*Acer rubrum - Nyssa sylvatica* Saturated Forest Alliance (A.348)
Alliance (English name)	Red Maple - Blackgum Saturated Forest Alliance
Association	*Acer rubrum - Nyssa sylvatica / Ilex verticillata - Vaccinium fuscatum / Osmunda cinnamomea* Forest
Association (English name)	Red Maple - Blackgum / Common Winterberry - Black Highbush Blueberry / Cinnamon Fern Forest
Ecological System(s):	Central Appalachian Stream and Riparian (CES202.609).

GLOBAL DESCRIPTION

Concept Summary: This community occurs on groundwater-saturated flats and low slopes along streams in the Ridge and Valley, northern Cumberland Plateau, northern Blue Ridge, and western Piedmont at elevations of 200–900 m (700–2900 ft). Habitats are usually more-or-less narrow and elongate, with hummock-and-hollow microtopography, and frequently with a small ephemeral stream channel running through or adjacent to the community. Substrates are poorly drained mineral soils with numerous hydric indicators. The ground surface is slightly sloping,

and drainage is usually via small, intricately braided channels with interspersed hummocks. The canopy is usually closed and consists of *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), and *Liriodendron tulipifera* (tuliptree). *Quercus alba* (white oak) is an important associate in some areas, and *Ulmus rubra* (slippery elm), *Fraxinus americana* (white ash), and *Platanus occidentalis* (American sycamore) are present in some stands. Minor or local tree species include *Magnolia acuminata* (cucumber-tree), *Tsuga canadensis* (eastern hemlock), *Betula lenta* (sweet birch), *Pinus rigida* (pitch pine), and *Pinus strobus* (eastern white pine). The shrub stratum may be well-developed and includes *Ilex verticillata* (common winterberry), *Ilex opaca* (American holly), *Vaccinium* (blueberry) *corymbosum*, *Kalmia latifolia* (mountain laurel), *Alnus serrulata* (hazel alder), *Viburnum nudum* var. *cassinoides* (withe-rod), *Viburnum dentatum* (southern arrow-wood), *Smilax* (greenbrier) spp., and, less consistently, *Carpinus caroliniana* (American hornbeam), *Asimina triloba* (pawpaw), *Euonymus americanus* (strawberry bush), *Lindera benzoin* (northern spicebush), *Gaylussacia frondosa* (blue huckleberry), *Gaylussacia baccata* (black huckleberry), *Menziesia pilosa* (minniebush), *Vaccinium fuscatum* (black highbush blueberry), *Chionanthus virginicus* (white fringetree), *Viburnum nudum* var. *nudum* (possumhaw), *Rhododendron viscosum* (swamp azalea), and *Toxicodendron vernix* (poison-sumac). *Rubus hispidus* (bristly dewberry) is an abundant creeping vine in many stands. Typical herbaceous plants include *Osmunda cinnamomea* (cinnamon fern), *Carex gynandra* (nodding sedge), *Carex lurida* (shallow sedge), *Carex atlantica* (prickly bog sedge), *Carex debilis* (white edge sedge), *Thelypteris noveboracensis* (New York fern), *Platanthera clavellata* (small green wood orchid), *Chelone glabra* (white turtlehead), *Medeola virginiana* (Indian cucumber), *Dioscorea quaternata* (fourleaf yam), *Juncus effusus* (common rush), *Lycopus uniflorus* (northern bugleweed), *Lycopodium obscurum* (rare clubmoss), *Osmunda regalis* var. *spectabilis* (royal fern), *Symplocarpus foetidus* (skunk-cabbage), *Veratrum viride* (green false hellebore), *Viola hastata* (halberdleaf yellow violet), and *Viola cucullata* (marsh blue violet).
Environmental Description: This community occurs on groundwater-saturated flats along low- to middle-elevation streams and headwaters seeps in areas underlain by acidic sedimentary and metamorphic rocks. It is a small-patch type that is particularly frequent and well-developed in the large alluvial fans along the western foot of the northern Blue Ridge and in small-stream valleys and low-gradient plateau drainages of the Ridge and Valley province and parts of the Cumberland Plateau. Outliers occur throughout the western Piedmont, particularly in districts underlain by acidic metasedimentary rocks. Habitats are usually more-or-less narrow and elongate, with hummock-and-hollow microtopography, and frequently with a small ephemeral stream channel running through or adjacent to the community. Substrates are poorly drained mineral soils with numerous hydric indicators, including saturated horizons, oxidized root channels, low chroma, gley, and mottles. Local areas of organic muck sometimes accumulate in depressions. The ground surface is slightly sloping, and drainage is usually via small, intricately braided channels with interspersed hummocks. Moss mats, predominantly of *Sphagnum* (sphagnum) spp., are usually abundant and provide a rooting medium for herbaceous species. Soils collected from plot samples are very strongly acidic with moderately low to very low base status. Patches of this community are mostly shaded by overhanging trees, but sunny spots may be created by canopy gaps, and larger patches may have small open centers.
Vegetation Description: This forest association has an open to closed canopy of *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), and *Liriodendron tulipifera* (tuliptree). *Quercus alba* is an important associate in some areas, and *Ulmus rubra* (slippery elm), *Fraxinus americana* (white ash), and *Platanus occidentalis* (American sycamore) are present in some stands. *Pinus*

rigida (pitch pine) is a frequent overstory associate in some Ridge and Valley and Blue Ridge stands, although its numbers have been recently reduced by southern pine beetle outbreaks. Minor tree species, especially at the higher elevations, include *Magnolia acuminata* (cucumber-tree), *Tsuga canadensis* (eastern hemlock), *Betula lenta* (sweet birch), and *Pinus strobus* (eastern white pine). A single, anomalous stand in Augusta County, Virginia, contains an abundance of the disjunct Coastal Plain tree *Magnolia virginiana* (sweetbay) (Carr 1939). *Amelanchier arborea* (common serviceberry) is usually common in the understory, along with reproduction of *Acer rubrum* (red maple) and *Nyssa sylvatica* (blackgum). The shrub stratum is often well-developed and includes *Ilex verticillata* (common winterberry), *Ilex opaca* (American holly), *Kalmia latifolia* (mountain laurel), *Alnus serrulata* (hazel alder), *Viburnum dentatum* (southern arrow-wood), *Photinia pyrifolia* (red chokeberry), *Vaccinium corymbosum* (highbush blueberry), and *Smilax* (greenbrier) spp. Less frequent, but locally important, shrubs include *Asimina triloba* (pawpaw), *Vaccinium fuscatum* (black highbush blueberry), *Euonymus americanus* (strawberry bush), *Toxicodendron vernix* (poison-sumac), *Viburnum nudum* var. *nudum* (possumhaw), *Viburnum nudum* var. *cassinoides* (withe-rod), *Menziesia pilosa* (minniebush), *Carpinus caroliniana* (American hornbeam), *Chionanthus virginicus* (white fringetree), *Lindera benzoin* (northern spicebush), *Gaylussacia frondosa* (blue huckleberry), *Rhododendron catawbiense* (Catawba rosebay), *Rhododendron periclymenoides* (pink azalea), and *Rhododendron viscosum* (swamp azalea). *Rubus hispidus* (bristly dewberry) is an abundant creeping vine in many stands; *Smilax rotundifolia* (roundleaf greenbrier) may also be present. The most characteristic herbaceous plants are *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* var. *spectabilis* (royal fern), *Platanthera clavellata* (small green wood orchid), *Chelone glabra* (white turtlehead), *Rubus hispidus* (bristly dewberry), *Viola cucullata* (marsh blue violet), *Carex gynandra* (nodding sedge), *Carex lurida* (shallow sedge), *Carex atlantica* (prickly bog sedge), *Carex debilis* (white edge sedge), *Oxypolis rigidior* (stiff cowbane), *Thelypteris noveboracensis* (New York fern), *Athyrium filix-femina* (common ladyfern), *Dioscorea quaternata* (fourleaf yam), *Juncus effusus* (common rush), *Lycopus uniflorus* (northern bugleweed), *Medeola virginiana* (Indian cucumber), *Polystichum acrostichoides* (Christmas fern), *Potentilla simplex* (common cinquefoil), and *Viola hastata* (halberdleaf yellow violet). Where shrubs are sparse, as in most of the West Virginia occurrences, fern cover is typically extensive. Less frequent but typical herbs include *Parnassia asarifolia* (kidneyleaf grass of Parnassus), *Carex intumescens* (greater bladder sedge), *Carex leptalea* (bristlystalked sedge), *Symplocarpus foetidus* (skunk-cabbage), *Veratrum viride* (green false hellebore), *Maianthemum canadense* (Canada mayflower), *Lycopodium obscurum*, *Onoclea sensibilis* (sensitive fern), *Leersia virginica* (whitegrass), *Boehmeria cylindrica* (small-spike false nettle), *Lycopus virginicus* (Virginia water horehound), *Glyceria striata* (fowl mannagrass), and *Dryopteris* (woodfern) *cristata*. Many additional herbaceous species, including several more typical of uplands, occur at low constancy and cover. The bryophyte layer may also be diverse; species of mosses and liverworts identified from plots include *Atrichum undulatum* (undulate atrichum moss), *Aulacomnium palustre* (aulacomnium moss), *Bryhnia novae-angliae* (New England bryhnia moss), *Callicladium haldanianum* (callicladium moss), *Campylium radicale* (campylium moss), *Dicranum scoparium* (dicranum moss), *Hypnum imponens* (hypnum moss), *Jungermannia gracillima*, *Leucobryum albidum* (leucobryum moss), *Mnium hornum* (horn calcareous moss), *Pellia epiphylla*, *Plagiomnium ciliare* (plagiomnium moss), *Platygyrium repens*, *Steerecleus serrulatus* (steerecleus moss), and *Thuidium delicatulum* (delicate thuidium moss). Mean vascular plant

species richness of 37 plot-sampled stands in Virginia and West Virginia is 47 taxa per 400 square meters.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
		Liriodendron tulipifera (tuliptree)
		Nyssa sylvatica (blackgum)
		Quercus alba (white oak)
Herb (field)	Fern or fern ally	*Thelypteris noveboracensis* (New York fern)

Characteristic Species: *Acer rubrum* (red maple), *Alnus serrulata* (hazel alder), *Aulacomnium palustre* (aulacomnium moss), *Bryhnia novae-angliae* (New England bryhnia moss), *Callicladium haldanianum* (callicladium moss), *Campylium radicale* (campylium moss), *Carex baileyi* (Bailey's sedge), *Carex debilis* (white edge sedge), *Carex folliculata* (northern long sedge), *Carex intumescens* (greater bladder sedge), *Carex prasina* (drooping sedge), *Chelone glabra* (white turtlehead), *Cinna arundinacea* (sweet woodreed), *Dichanthelium dichotomum* (cypress panicgrass), *Glyceria melicaria* (melic mannagrass), *Glyceria striata* (fowl mannagrass), *Ilex verticillata* (common winterberry), *Juncus effusus* (common rush), *Liriodendron tulipifera* (tuliptree), *Lycopus uniflorus* (northern bugleweed), *Mnium hornum* (horn calcareous moss), *Nyssa sylvatica* (blackgum), *Osmunda cinnamomea* (cinnamon fern), *Oxypolis rigidior* (stiff cowbane), *Pellia epiphylla* (common pellia), *Plagiomnium ciliare* (plagiomnium moss), *Platanthera clavellata* (small green wood orchid), *Rubus hispidus* (bristly dewberry), *Thelypteris noveboracensis* (New York fern), *Viola cucullata* (marsh blue violet).

Other Noteworthy Species:

Species	GRank	Type	Note
Eriocaulon decangulare (tenangle pipewort)	-	plant	VA state-imperiled
Helonias bullata (swamppink)	G3	plant	Federally listed threatened

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: The documented range of this community type encompasses the Central Appalachians of Maryland and Virginia, and the Cumberland Mountains in West Virginia. In Virginia, it is scattered throughout the mountains and, more locally, the western Piedmont (Allard and Leonard 1943).

States/Provinces: MD, NC, PA?, VA:S2S3, WV.

Federal Lands: NPS (Appalachian Trail, Blue Ridge Parkway, Gauley River, New River Gorge, Shenandoah); USFS (George Washington).

CONSERVATION STATUS

Rank: G3G4 (1-Oct-2001).

Reasons: This association has a narrow geographic range and is further limited by its requirement for special, localized wetlands. The type is confined to groundwater-saturated, nutrient-poor habitats that are large enough to support forest vegetation.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Examples occur near the Maple Flats pond complex (Augusta County, Virginia). This community is also known from Massanutten Mountain (Lee District, George Washington National Forest), elsewhere along the foot of the Blue Ridge (north of Maple Flats), a site on the northern Blue Ridge in Loudoun County, Virginia (owned by The Appalachian Trail Club), and

in the Bull Run Mountains of Virginia, an isolated Piedmont foothill in Fauquier and Prince William counties, Virginia; occurrences in the latter two areas do not have *Pinus rigida* (pitch pine) (or much of it) but are otherwise very similar (Fleming 1998). Quantitative analysis of a 1300-plot regional dataset for the National Capital Region Parks Vegetation Mapping Project Phase I indicate that a portion of Gould and Berdine's (1998) "circumneutral" seepage swamp community from Catoctin Mountain, Maryland, also corresponds to this type. It has also been sampled in West Virginia, where occurrences generally lack a dense shrub layer and are characterized by heavy fern cover.

There are unresolved issues regarding conceptual overlap between this type and *Acer rubrum - Nyssa sylvatica* High Allegheny Plateau, Central Appalachian Forest (CEGL006132). The latter type is a broadly defined community type that encompasses both seepage wetlands and poorly drained depressions. The community classified and described here for Virginia is limited conceptually to flow-through, groundwater-seepage wetlands. Communities with similar *Acer - Nyssa* canopies but occurring in saturated to seasonally flooded depression wetlands without apparent seepage inputs have been documented in Virginia but are not treated due to insufficient data. Nevertheless, they appear to warrant segregation from the seepage wetland communities because of their hydrologic regime, distinctly different herbaceous composition, and much lower species richness.

This type is currently under-represented by plot data, but observations suggest that it is relatively consistent in its composition and environmental affiliations. However, community characterization and nomenclature are subject to change pending further data collection and analysis, ideally based on wider geographic sampling. The recognition of segregate associations, subassociations, or variants may also be warranted following additional assessment. Lower-elevation sites are characterized by *Amianthium muscitoxicum* (flypoison), *Brachyelytrum erectum* (bearded shorthusk), *Carex debilis* (white edge sedge), *Carex intumescens* (greater bladder sedge), *Cypripedium acaule* (moccasin flower), *Gaylussacia frondosa* (blue huckleberry), *Lindera benzoin* (northern spicebush), *Platanthera ciliaris* (yellow fringed orchid), *Platanthera clavellata* (small green wood orchid), *Uvularia sessilifolia* (sessileleaf bellwort), *Viburnum nudum* var. *nudum* (possumhaw), and *Viola X primulifolia* (primroseleaf violet). Middle-elevation sites are characterized by *Oclemena acuminata* (whorled wood aster), *Betula lenta* (sweet birch), *Magnolia acuminata* (cucumber-tree), *Pinus strobus* (eastern white pine), *Rhododendron catawbiense* (Catawba rosebay), and *Rhododendron viscosum* (swamp azalea). A single site (Magnolia Swamp), possibly with boggier or more organic soils, is characterized by *Magnolia virginiana* (sweetbay), *Arethusa bulbosa* (dragon's mouth), *Dulichium arundinaceum* (threeway sedge), *Juncus effusus* (common rush), *Parthenocissus quinquefolia* (Virginia creeper), *Triadenum virginicum* (Virginia marsh St. Johnswort), and *Woodwardia areolata* (netted chainfern).

This type is similar in many respects to, and intergrades with, Montane Basic Seepage Swamps that are situated on calcareous soils derived from metabasalt (greenstone) and carbonate rock substrates [see *Acer rubrum - Fraxinus americana - Fraxinus nigra - Betula alleghaniensis / Veratrum viride - Carex bromoides* Forest (CEGL008416)]. These environmentally disparate swamps share a surprising number of prominent species including *Acer rubrum* (red maple), *Symplocarpus foetidus* (skunk-cabbage), *Veratrum viride* (green false hellebore), *Osmunda*

cinnamomea (cinnamon fern), *Osmunda regalis* var. *spectabilis* (royal fern), *Carex leptalea* (bristlystalked sedge), etc. Acidic seepage swamps, however, have lower species richness and mostly lack distinctly base-loving species such as *Fraxinus americana* (white ash), *Fraxinus nigra* (black ash), *Caltha palustris* (yellow marsh-marigold), *Carex bromoides* (bromelike sedge), *Saxifraga pensylvanica* (eastern swamp saxifrage), etc. *Sphagnum* (sphagnum) mosses, as well as many vascular plants that characterize Acidic Seepage Swamps, are absent or unimportant in the calcareous swamps. Examples include *Pinus rigida* (pitch pine), *Nyssa sylvatica* (blackgum), *Viburnum nudum* (possumhaw), *Parnassia asarifolia* (kidneyleaf grass of Parnassus), *Platanthera ciliaris* (yellow fringed orchid), *Platanthera clavellata* (small green wood orchid), *Rubus hispidus* (bristly dewberry), *Lycopodium obscurum* (rare clubmoss), *Carex debilis* (white edge sedge), and *Carex folliculata* (northern long sedge) (Fleming and Van Alstine 1999).

Formerly a common canopy tree of this community type in certain localities (e.g., Maple Flats, Augusta County), *Pinus rigida* (pitch pine) has been nearly eliminated from many stands by a recent outbreak of southern pine beetles (*Dendroctonus frontalis*).

Similar Associations:

- *Acer rubrum - Fraxinus americana - Fraxinus nigra - Betula alleghaniensis / Veratrum viride - Carex bromoides* Forest (CEGL008416).
- *Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum* var. *nudum / Osmunda cinnamomea - Woodwardia areolata* Forest (CEGL006238).
- *Acer rubrum - Nyssa sylvatica* High Allegheny Plateau, Central Appalachian Forest (CEGL006132).

Related Concepts:

- *Acer rubrum - Fraxinus pennsylvanica - Betula (alleghaniensis, lenta) / Ilex verticillata / Symplocarpus foetidus* Forest (Gould and Berdine 1998) I
- *Acer rubrum - Liriodendron tulipifera / Ilex verticillata - Vaccinium fuscatum / Osmunda cinnamomea - Symplocarpus foetidus* Forest (Fleming 2002a) =
- *Acer rubrum - Nyssa sylvatica - Pinus rigida / Ilex verticillata / Osmunda cinnamomea* community (Fleming and Van Alstine 1999) ?
- *Acer rubrum - Nyssa sylvatica / Vaccinium fuscatum - Ilex verticillata / Osmunda cinnamomea* Forest (Fleming and Coulling 2001) =
- *Acer rubrum / Thelypteris noveboracensis* forest seep (Vanderhorst 2001b) =
- Mountain / Piedmont Acidic Seepage Swamp (Fleming and Coulling 2001) ?

SOURCES

Description Authors: G. Fleming and P. Coulling, mod. S. C. Gawler.

References: Allard and Leonard 1943, Byers et al. 2007, Carr 1939, Fleming 1998, Fleming 2002a, Fleming and Coulling 2001, Fleming and Van Alstine 1999, Fleming et al. 2001, Fleming pers. comm., Gould and Berdine 1998, Southeastern Ecology Working Group n.d., VDNH 2003, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2010, Young et al. 2006.


Plot GARI.195. Forest Seep.

COMMON NAME (PARK-SPECIFIC): EASTERN HEMLOCK PLATEAU FOREST AND SUCCESSIONAL PITCH PINE FORES.

SYNONYMS

USNVC English Name: **Tuliptree - Eastern White Pine - Eastern Hemlock - (Northern Red Oak, White Oak) / Christmas Fern Forest**

USNVC Scientific Name: ***Liriodendron tulipifera - Pinus strobus - Tsuga canadensis - Quercus (rubra, alba) / Polystichum acrostichoides* Forest**

USNVC Identifier: **CEGL006304**

LOCAL INFORMATION

Environmental Description: This association occurs in large patches on residual soils of upper slopes, ridgetops, and rolling plateaus. Sites have relatively high solar exposure. Dominance by *Tsuga canadensis* (eastern hemlock) in these exposed landscape positions is somewhat unusual and can be attributed to the general landscape dominance of the species in the eastern two-thirds of the park. Landscape dominance of *Tsuga canadensis* (eastern hemlock) in GARI is a reflection of the area's temperate climate with relatively high rainfall combined with the preponderance of well-drained coarse-textured acidic soils derived primarily from sandstone. Slopes in mapped polygons range from 0.3 to 48 degrees (mean = 10.7). Elevations in mapped polygons range from 295 to 611 m (mean = 458). Bedrock geology is primarily sandstones of the New River and Kanawha formations in the Pottsville group. Unvegetated ground cover is strongly dominated by litter with significant accumulations of woody debris in some areas, especially where successional pines are dying and breaking up. Soils in plots are described as well-drained, dry to moist sandy loam, sandy clay loam, silt loam, loam, and silty clay. Soils test strongly to extremely acidic (mean pH = 4.39) with relatively high levels of total exchange capacity, estimated N release, S, and Al, and relatively low levels of B, Cu, Fe, Mg, and Zn compared to average values from all plots in the park. This association is often uphill from Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543), which occurs in more mesic gorge slope positions. Adjacent associations on the plateaus include Oak - Hickory Forest (CEGL007267), Successional Tuliptree Forest (CEGL007221), and Successional Virginia Pine Forest (CEGL002591).

Vegetation Description: This association is a mixed evergreen-deciduous forest codominated by *Tsuga canadensis* (eastern hemlock) and lacking significant cover by the evergreen shrub *Rhododendron maximum* (great laurel). Canopies are tall (>20 m) with cover in plots ranging from 40 to 80%. *Tsuga canadensis* (eastern hemlock) is a canopy tree in mature stands but may be overtopped by deciduous trees or *Pinus rigida* (pitch pine) in younger stands. Codominant deciduous trees include *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), and *Fagus grandifolia* (American beech). Additional characteristic trees in the canopy and subcanopy include *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Betula lenta* (sweet birch), *Carya alba* (mockernut hickory), and *Carya glabra* (pignut hickory). The shrub layers are typically dominated by saplings of *Tsuga canadensis* (eastern hemlock). *Smilax rotundifolia* (roundleaf greenbrier) and *Ilex opaca* var. *opaca* (American holly) have high constancy in the shrub layers. The herb layer usually has sparse cover and low diversity. Common herbs include *Polystichum acrostichoides* (Christmas fern), *Mitchella repens* (partridgeberry), *Viola hastata* (halberdleaf yellow violet), *Monotropa uniflora* (Indianpipe), *Medeola virginiana* (Indian cucumber), and *Dryopteris*

intermedia (intermediate woodfern). Vascular plant species richness in plots ranges from 21 to 47 taxa (mean = 28.5). Nonvascular cover is usually sparse. Mosses identified in plots include *Thuidium delicatulum* (delicate thuidium moss), *Leucobryum glaucum* (leucobryum moss), *Leucobryum albidum* (leucobryum moss), *Hypnum imponens* (hypnum moss), and *Dicranum fulvum* (dicranum moss).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	.	.	[not crosswalked]	.

Local Range: This association occurs on the plateaus in the eastern two-thirds of the park.
Classification Comments: Stands of this association at GARI differ from the global description by completely lacking *Pinus strobus* (eastern white pine) and by occurring in upper slope and plateau positions. These differences may be related to relatively high rainfall and acidic sandstone bedrock geology in this area which does not promote *Pinus strobus* (eastern white pine) and which allows *Tsuga canadensis* (eastern hemlock) to dominate in all topographic positions. At GARI, this association grades towards Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543), which usually occurs downhill on colluvial gorge slopes and is best distinguished by having high cover by *Rhododendron maximum* (great laurel). A few stands mapped as Successional Pitch Pine Forest are included in this association because there is no existing USNVC association for successional stands dominated by *Pinus rigida* (pitch pine), and at GARI these stands are succeeding towards dominance by *Tsuga canadensis* (eastern hemlock).
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Seven plots were sampled: GARI.38, GARI.56, GARI.73, GARI.94, GARI.102, GARI.194, and GARI.216.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	*Pinus strobus - Quercus (alba, rubra, velutina)* Forest Alliance (A.401)
Alliance (English name)	Eastern White Pine - (White Oak, Northern Red Oak, Black Oak) Forest Alliance
Association	*Liriodendron tulipifera - Pinus strobus - Tsuga canadensis - Quercus (rubra, alba) / Polystichum acrostichoides* Forest
Association (English name)	Tuliptree - Eastern White Pine - Eastern Hemlock - (Northern Red Oak, White Oak) / Christmas Fern Forest
Ecological System(s):	Northeastern Interior Dry-Mesic Oak Forest (CES202.592).

GLOBAL DESCRIPTION

Concept Summary: mixed hardwood - white pine - hemlock cove forest is widely but locally distributed in the southern part of the Central Appalachians in Virginia, West Virginia, and

Maryland. It occurs on the lower slopes and bottoms of ravines and coves at lower elevations, generally below 915 m (3000 ft). Sites may be underlain by bedrock or colluvial and alluvial deposits of various sedimentary and metasedimentary rocks, granitic rocks, or metabasalt. Habitats are generally mesic with acidic soils of moderate or intermediate fertility. The overstory is codominated by variable mixtures *Liriodendron tulipifera* (tuliptree), *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), *Quercus rubra* (northern red oak), and *Quercus alba* (white oak). This forest generally has a moderate to strong evergreen component, but *Pinus strobus* (eastern white pine) varies from widely scattered to codominant, and *Tsuga canadensis* (eastern hemlock) has been greatly reduced by recent outbreaks of the hemlock woolly adelgid and may be restricted to the understory. Less frequent overstory associates include *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Carya* (hickory) spp., *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Nyssa sylvatica* (blackgum), and *Quercus prinus* (chestnut oak). Characteristic understory species include *Acer pensylvanicum* (striped maple), *Amelanchier arborea* (common serviceberry), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Ostrya virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Viburnum acerifolium* (mapleleaf viburnum), *Rubus* (blackberry) spp., *Corylus americana* (American hazelnut), *Hamamelis virginiana* (American witchhazel), *Hydrangea arborescens* (wild hydrangea), and *Lindera benzoin* (northern spicebush). The herb layer is usually patchy to moderately dense. Frequent patch-dominants include *Amphicarpaea bracteata* (American hogpeanut), *Dennstaedtia punctilobula* (eastern hayscented fern), *Eurybia divaricata* (white wood aster), and *Polystichum acrostichoides* (Christmas fern). Other constant but low-cover herbs include *Botrychium virginianum* (rattlesnake fern), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea quaternata* (fourleaf yam), *Galium triflorum* (fragrant bedstraw), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Mitchella repens* (partridgeberry), and *Stellaria pubera* (star chickweed). Many additional herbs occur at low constancy.

Environmental Description: This community occurs at lower elevations, generally below 915 m (3000 ft), on the lower slopes and bottoms of ravines and coves, extending to upper slopes, ridgetops, and rolling plateaus on parts of the Cumberland Plateau. Sites may be underlain by bedrock or colluvial and alluvial deposits of various metasedimentary rocks, granitic rocks, or metabasalt. Habitats are generally mesic with acidic soils of moderate or intermediate fertility. Soils are mostly well-drained, dry to moist sandy loam, sandy clay loam, silt loam, loam, and silty clay.

Vegetation Description: The overstory is codominated by variable mixtures of *Liriodendron tulipifera* (tuliptree), *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), and *Quercus alba* (white oak). This forest generally has a moderate to strong evergreen component, but *Pinus strobus* (eastern white pine) varies from absent to widely scattered to codominant, and *Tsuga canadensis* (eastern hemlock) has been greatly reduced in many areas by recent outbreaks of the hemlock woolly adelgid and may be restricted to the understory. Less frequent overstory associates include *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Carya* (hickory) *alba*, *Carya glabra* (pignut hickory), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Nyssa sylvatica* (blackgum), and *Quercus prinus* (chestnut oak). The subcanopy is of variable cover and may include *Acer pensylvanicum* (striped maple), *Acer rubrum* (red maple), *Amelanchier arborea* (common serviceberry), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Ostrya virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Nyssa*

sylvatica (blackgum), *Pinus strobus* (eastern white pine), and *Tsuga canadensis* (eastern hemlock). The shrub layer is typically patchy or open and characterized by *Viburnum acerifolium* (mapleleaf viburnum), *Rubus* (blackberry) spp., *Corylus americana* (American hazelnut), *Hamamelis virginiana* (American witchhazel), *Hydrangea arborescens* (wild hydrangea), *Ilex opaca* (American holly), and *Lindera benzoin* (northern spicebush). The herb layer is usually patchy to moderately dense. Frequent patch-dominants include *Amphicarpaea bracteata* (American hogpeanut), *Dennstaedtia punctilobula* (eastern hayscented fern), *Eurybia divaricata* (white wood aster), and *Polystichum acrostichoides* (Christmas fern). Other constant but low-cover herbs include *Botrychium virginianum* (rattlesnake fern), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea quaternata* (fourleaf yam), *Galium triflorum* (fragrant bedstraw), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Medeola virginiana* (Indian cucumber), *Mitchella repens* (partridgeberry), *Stellaria pubera* (star chickweed), *Viola hastata* (halberdleaf yellow violet), and *Dryopteris intermedia* (intermediate woodfern). Many additional herbs occur at low constancy. Species richness of 34 Virginia and West Virginia plot samples ranges from 21 to 98 taxa per 400 square meters (mean = 57), with the WV plots decidedly less species-rich (WV mean=28.5 spp.; VA mean = 64 spp.).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community occurs in the southern portion of the Central Appalachians of Maryland, West Virginia, and Virginia, extending to the adjacent Cumberland Plateau in West Virginia. It is rare in the western Piedmont foothills of Virginia, adjacent to the Blue Ridge.
States/Provinces: MD, OH, VA:S4, WV.
Federal Lands: NPS (Appalachian Trail, Blue Ridge Parkway, Gauley River, Shenandoah); USFS (George Washington, Jefferson, Wayne).

CONSERVATION STATUS

Rank: G4? (25-Jan-2008).
Reasons: This community appears to be widely but locally distributed over a large part of the Central Appalachians in Virginia, West Virginia, and Maryland. The type frequently forms large patches in suitable mesic habitats, but mature, high-quality stands are uncommon due to extensive past logging and more recent biotic disturbances (e.g., hemlock woolly adelgid).

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 3 - Weak.
Comments: This association is represented by 35 Virginia plots, all of which have been analyzed in a statewide classification (>1300 plots) of montane upland forests and woodlands (Fleming and Patterson 2009b). Ten plots from the southern part of the Central Appalachians were classified as this association in the Appalachian Trail classification project (Fleming and Patterson 2009a).

Similar Associations:

- *Liriodendron tulipifera - Pinus strobus - (Tsuga canadensis) / Carpinus caroliniana / Amphicarpaea bracteata* Forest (CEGL008405)--very similar but currently defined as a montane alluvial forest of small-stream floodplains.
- *Pinus strobus - Quercus alba - Quercus prinus / Vaccinium stamineum* Forest (CEGL008539)--occurs on drier sites, primarily in the central Appalachian Ridge and Valley province and the Piedmont.
- *Pinus strobus - Tsuga canadensis / Acer pensylvanicum / Polystichum acrostichoides* Forest (CEGL006019)--evergreen forest restricted to the northern part of the Central Appalachians.
- *Tsuga canadensis - Quercus prinus - Liriodendron tulipifera / Kalmia latifolia - (Rhododendron catawbiense)* Forest (CEGL008512)--occurs in the same region but occupies extremely infertile coves, mostly on acidic granite, sandstone, and quartzite.

Related Concepts:

- Acidic Cove Forest (Fleming et al. 2001) B
- White pine-oak-tuliptree dry forest (CAP pers. comm. 1998) B

SOURCES

Description Authors: G. P. Fleming, mod. S. C. Gawler.

References: CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Fleming and Patterson 2009a, Fleming and Patterson 2009b, Fleming et al. 2001, Harrison 2004, Vanderhorst et al. 2010, Young et al. 2006.

Plot GARI.216. Eastern Hemlock Plateau Forest.

Plot GARI.143. Successional Pitch Pine Forest.

COMMON NAME (PARK-SPECIFIC): YELLOW BIRCH COLD COVE FOREST

SYNONYMS

USNVC English Name:	**Yellow Birch - (Eastern Hemlock) / Great Laurel / (Mountain Doghobble) Forest**
USNVC Scientific Name:	***Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / (Leucothoe fontanesiana)* Forest**
USNVC Identifier:	**CEGL007861**

LOCAL INFORMATION

Environmental Description: This association is confined to a few locations on lower gorge slopes that have northeasterly aspects with extremely low solar exposure. Slopes are steep and substrates are bouldery colluvium. Slopes in mapped polygons range from 14 to 38 degrees (mean = 25). Elevations in mapped polygons range from 348 to 501 m (mean = 421). Bedrock geology is mapped as sandstone of the New River formation in the Pottsville group. Soils in plots are described as well-drained, somewhat-moist to moist sandy loam. Soils test strongly to extremely acidic (mean pH = 4.33) with relatively high levels of organic matter, estimated N release, and Na, and relatively low levels of S, Al, Cu, Mn, P, and Zn compared to average values from all plots in the park. This association is embedded within the matrix Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543). Stands are truncated by a railroad grade uphill. Downhill from this association are floodplain and riparian communities.
Vegetation Description: This association represents deciduous and mixed deciduous-conifer forests having a large component of *Betula alleghaniensis* var. *alleghaniensis* (yellow birch). Canopies are tall (>20 m) with cover in plots ranging from 30 to 70%. Associated canopy trees include *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Tsuga canadensis* (eastern hemlock), and *Magnolia fraseri* (mountain magnolia). Cover in the subcanopy of plots ranges from 20 to 80%. Additional tree species in the subcanopy include *Amelanchier arborea* var. *arborea* (common serviceberry), *Ilex opaca* var. *opaca* (American holly), and *Nyssa sylvatica* (blackgum). Shrub layers are well-developed and include *Rhododendron maximum* (great laurel), *Clethra acuminata* (mountain sweetpepperbush), *Hamamelis virginiana* (American witchhazel), and *Smilax rotundifolia* (roundleaf greenbrier). Cover by herbs is sparse to moderate. Common herbs include *Eurybia divaricata* (white wood aster), *Dryopteris intermedia* (intermediate woodfern), *Polystichum acrostichoides* (Christmas fern), *Polypodium virginianum* (rock polypody), *Anemone quinquefolia* var. *quinquefolia* (nightcaps), and *Tiarella cordifolia* (heartleaf foamflower). The West Virginia state-rare sedge *Cymophyllus fraserianus* (Fraser's cymophyllus) occurs in one stand. Vascular plant species richness in plots ranges from 20 to 27 taxa (mean = 23). Bryophytes identified in plots include *Thuidium delicatulum* (delicate thuidium moss), *Hypnum imponens* (hypnum moss), *Aulacomnium heterostichum* (aulacomnium moss), *Bryoandersonia illecebra* (bryoandersonia moss), *Bazzania trilobata* (common Bazzania liverwort), *Leucobryum glaucum* (leucobryum moss), and *Mnium hornum* (horn calcareous moss).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	.	.	[not crosswalked]	.

Local Range: There are two stands in the eastern half of GARI, one on river left along the Meadow River, and one on river left on the Gauley River near Iron Ring Rapids.
Classification Comments: Stands at GARI are very small and are embedded within the related Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543). Stands of this association can be differentiated from all other types at GARI by having a large component of *Betula alleghaniensis* var. *alleghaniensis* (yellow birch).
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Three plots were sampled: GARI.159, GARI.209, and GARI.210.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	*Tsuga canadensis - Betula alleghaniensis* Forest Alliance (A.412)
Alliance (English name)	Eastern Hemlock - Yellow Birch Forest Alliance
Association	*Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / (Leucothoe fontanesiana)* Forest
Association (English name)	Yellow Birch - (Eastern Hemlock) / Great Laurel / (Mountain Doghobble) Forest
Ecological System(s):	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593). Southern Appalachian Northern Hardwood Forest (CES202.029).

GLOBAL DESCRIPTION

Concept Summary: This association occurs in the Great Smoky Mountains and high mountain areas of southwestern Virginia, and at lower elevations in protected mountain settings in West Virginia. This community is found on steep, mostly north-facing slopes, and on slopes and flats along and above streams. These forests occur on midslope or toeslope positions, protected by higher landforms, where solar exposure is very low. The elevations of samples range from as low as 320 m in West Virginia (1040 ft) to around 1350 m (4400 ft), but the community can probably occur as high as 1524 m (5000 ft) or until *Picea rubens* (red spruce) begins to dominate. Sites are rocky, often with many large boulders and talus. Soils are stony with heavy litter layers and pockets of colluvium. This forest is affected by occasional disturbance by ice, wind and landslides. This mixed forest type has an open to closed canopy dominated by *Betula alleghaniensis* (yellow birch) and/or *Tsuga canadensis* (eastern hemlock), although either of these species may be locally dominant at a small scale. In some stands, *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Liriodendron tulipifera* (tuliptree) (at lower elevations), *Tilia americana* var. *heterophylla* (American basswood), *Picea rubens* (red spruce), or *Quercus rubra* (northern red oak) can be important in the canopy or occur as minor associates. Other minor canopy and subcanopy species may include *Fagus grandifolia* (American beech), *Prunus serotina* (black cherry), and *Magnolia acuminata* (cucumber-tree). The tall-shrub stratum is over 2 m in height, very dense (50–100% coverage) and dominated by *Rhododendron maximum*

(great laurel). Other minor shrubs commonly include *Acer pensylvanicum* (striped maple), *Amelanchier laevis* (Allegheny serviceberry), *Amelanchier arborea* (common serviceberry), *Clethra acuminata* (mountain sweetpepperbush), *Hamamelis virginiana* (American witchhazel) (West Virginia), *Ilex montana* (mountain holly), and *Vaccinium erythrocarpum* (southern mountain cranberry). The ground layer is dominated by leaf litter, fallen trees and rocks. Herbaceous cover is sparse to moderate and is composed of scattered plants typical of mid- to high-elevation acidic forests. Composition can be quite variable among stands, but some of the more characteristic species include *Dryopteris intermedia* (intermediate woodfern), *Oclemena acuminata* (whorled wood aster), *Polystichum acrostichoides* (Christmas fern) (West Virginia), *Viola blanda* (sweet white violet), and *Viola rotundifolia* (roundleaf yellow violet). The bryophyte layer can be well-developed and diverse. This association grades into forests dominated by *Picea rubens* (red spruce) or *Tsuga canadensis* (eastern hemlock) at higher elevations.

Environmental Description: This community occurs on steep, mostly north-facing mesic slopes, and on toeslopes and flats along streams. It typically occupies mid- to lower slope and valley-bottom topographic positions that are well-protected by higher landforms. These sites have low solar exposure and may be subject to cold-air inversions. Elevations (of plot-sampled stands) range from 320–750 m (1040–2400 ft) in West Virginia, to 915–1450 m (3000–4800 ft) in the Virginia mountains, and to 1030–1450 m (3400–4800 ft) in the Great Smoky Mountains. Lower elevation stands may intergrade with *Betula lenta* (sweet birch)-dominated forest types. Sites are often rocky, with many large boulders and stones and pockets of colluvium. Soils, weathered from sandstone, acidic shale, or metamorphic igneous rocks, have dense, root-rich duff layers. Samples collected from plots are highly acidic (mean pH = 3.7 to 4.8) with low base status and moderately high organic matter content (mean = 20%). On stream-bottom sites, local areas of seepage are not uncommon, and habitats may be somewhat transitional to a saturated hydrologic regime. Sites occupied by this forest are affected by occasional ice, wind, and landslide disturbances.

Vegetation Description: This mixed forest has an open to closed canopy codominated by *Betula alleghaniensis* (yellow birch) and/or *Tsuga canadensis* (eastern hemlock), although either of these species may be solely dominant over small areas. In some stands, *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Liriodendron tulipifera* (tuliptree) (at lower elevations), *Tilia americana* var. *heterophylla* (American basswood), *Picea rubens* (red spruce), or *Quercus rubra* (northern red oak) can be important in the canopy or occur as minor associates. Other minor canopy and subcanopy species may include *Fagus grandifolia* (American beech), *Prunus serotina* (black cherry), and *Magnolia acuminata* (cucumber-tree). The community has a very dense (50–100% cover), evergreen tall-shrub stratum (>2 m tall) dominated by *Rhododendron maximum* (great laurel). In the Great Smoky Mountains, a dense low-shrub stratum dominated by *Leucothoe fontanesiana* (highland doghobble) is typical, but this species is absent from Virginia and West Virginia examples of the type. Other minor shrubs commonly include *Acer pensylvanicum* (striped maple), *Amelanchier laevis* (Allegheny serviceberry), *Hamamelis virginiana* (American witchhazel) (in West Virginia stands), *Ilex montana* (mountain holly), and *Vaccinium erythrocarpum* (southern mountain cranberry). Herbaceous cover is sparse to occasionally moderate and is composed of scattered plants typical of mid- to high-elevation acidic forests. Composition can be quite variable among stands, but some of the more characteristic species include *Dryopteris intermedia* (intermediate woodfern), *Oclemena acuminata* (whorled wood aster), *Polystichum acrostichoides* (Christmas fern) (in West Virginia

stands), *Viola blanda* (sweet white violet), and *Viola rotundifolia* (roundleaf yellow violet). Some additional herbaceous species found in this community include *Arisaema triphyllum* (Jack in the pulpit), *Dennstaedtia punctilobula* (eastern hayscented fern), *Huperzia lucidula* (shining clubmoss), and *Medeola virginiana* (Indian cucumber). In Southern Appalachian stands with very dense evergreen shrub layers, species richness can be extraordinarily low (<10 taxa per 1000-square-meter sample), but in stands with somewhat more open shrub layers, richness can exceed 30 taxa per sample. The bryophyte layer can be well-developed and diverse; mosses and liverworts collected from West Virginia plots include *Anomodon attenuatus* (anomodon moss), *Aulacomnium heterostichum* (aulacomnium moss), *Bryhnia graminicolor* (bryhnia moss), *Bryoandersonia illecebra* (bryoandersonia moss), *Campylium chrysophyllum* (goldenleaf campylium moss), *Hypnum curvifolium* (curveleaf hypnum moss), *Hypnum imponens* (hypnum moss), *Loeskeobryum brevirostre*, *Mnium stellare* (stellar calcareous moss), *Plagiothecium denticulatum* (toothed plagiothecium moss), *Platyhypnidium riparioides*, *Thuidium delicatulum* (delicate thuidium moss), *Bazzania trilobata* (common bazzania liverwort), *Leucobryum glaucum* (leucobryum moss), and *Mnium hornum* (horn calcareous moss).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Betula alleghaniensis* (yellow birch)
Tall shrub/sapling	Broad-leaved evergreen tree	*Rhododendron maximum* (great laurel)
Herb (field)	Fern or fern ally	*Dryopteris intermedia* (intermediate woodfern)

Characteristic Species: *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Botrychium oneidense* (bluntlobe grapefern), *Magnolia fraseri* (mountain magnolia), *Mitchella repens* (partridgeberry), *Oxalis montana* (mountain woodsorrel), *Picea rubens* (red spruce), *Polypodium appalachianum* (Appalachian polypody), *Polypodium virginianum* (rock polypody), *Polystichum acrostichoides* (Christmas fern), *Rhododendron maximum* (great laurel), *Ribes cynosbati* (eastern prickly gooseberry), *Tiarella cordifolia* (heartleaf foamflower), *Tsuga canadensis* (eastern hemlock), *Viola rotundifolia* (roundleaf yellow violet).

Other Noteworthy Species:

Species	GRank	Type	Note
Abies fraseri (Fraser fir)	G2	plant	globally imperiled
Botrychium oneidense (bluntlobe grapefern)	-	plant	
Catharus guttatus (hermit thrush)	-	animal	
Dendroica magnolia (magnolia warbler)	-	animal	
Geum geniculatum (bent avens)	G1G2	plant	globally imperiled
Hypericum mitchellianum (Blue Ridge St. Johnswort)	G3	plant	
Prenanthes roanensis (Roan Mountain rattlesnakeroot)	G3	plant	
Regulus satrapa (golden-crowned kinglet)	-	animal	
Sitta canadensis (red-breasted nuthatch)	-	animal	
Troglodytes troglodytes (winter wren)	-	animal	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community has been documented in the Great Smoky Mountains of Tennessee; in the Mount Rogers - Whitetop Mountain area of the Virginia Blue Ridge (Grayson, Smyth and Washington counties); on Salt Pond Mountain in the Ridge and Valley of west-central Virginia (Giles County); on Allegheny Mountain in Highland County, Virginia, and adjacent Pocahontas County, West Virginia; and in Fayette County, West Virginia, along and near the New River Gorge, and along Gauley River in West Virginia. This vegetation type may be locally distributed throughout higher elevations of the Southern and Central Appalachians.

States/Provinces: NC, TN, VA:S2, WV.

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Appalachian Trail, Blue Ridge Parkway, Gauley River, Great Smoky Mountains, New River Gorge); USFS (Cherokee, George Washington, Jefferson).

CONSERVATION STATUS

Rank: G3G4 (24-Feb-2010).

Reasons: This community type is naturally uncommon within its range due to specific requirements for protected, mesic sites at high elevations. Most remaining examples of this community have been affected by past logging and are currently threatened with the loss of their *Tsuga canadensis* (eastern hemlock) component due to ongoing or potential infestations by the exotic pest hemlock woolly adelgid (*Adelges tsugae*). This community type has a restricted but locally extensive distribution in the highest mountains of southwestern and west-central Virginia. This association was originally described from Great Smoky Mountains National Park.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This association is a high-elevation acidic cove forest and is characterized by species indicative of montane, infertile environments, a dense shrub layer of *Rhododendron maximum* (great laurel), and a mixed deciduous-evergreen to mostly deciduous canopy. Species richness is typically low, ranging from 4 to 38 species per sample with an average of 19 species per 400-square-meter sample. Analysis of plot samples from the Great Smoky and Virginia mountains, and from Fayette and Raleigh counties, West Virginia, shows the most constant species as *Betula alleghaniensis* (yellow birch), *Rhododendron maximum* (great laurel), *Tsuga canadensis* (eastern hemlock), and *Dryopteris intermedia* (intermediate woodfern).

Some stands in West Virginia may be better classified as *Tsuga canadensis - Betula alleghaniensis - Prunus serotina / Rhododendron maximum* Forest (CEGL006206), a seemingly more diverse and lower-elevation type. Forests of high-elevation coves at Salt Pond Mountain in Giles County (e.g., War Spur Branch), where *Picea rubens* (red spruce) is codominant with or subordinate to *Tsuga canadensis* (eastern hemlock) and *Betula alleghaniensis* (yellow birch), are tentatively placed here. Some of these stands, however, may be better classified as wetlands and require additional investigation.

Similar Associations:

- *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543).
- *Picea rubens - (Betula alleghaniensis, Aesculus flava) / Rhododendron (maximum, catawbiense)* Forest (CEGL004983).
- *Picea rubens - (Betula alleghaniensis, Aesculus flava) / Viburnum lantanoides / Oxalis montana - Solidago glomerata* Forest (CEGL006256).
- *Picea rubens / Betula alleghaniensis / Bazzania trilobata* Forest (CEGL008501).
- *Tsuga canadensis - (Betula alleghaniensis, Quercus rubra) / Ilex montana / Rhododendron catawbiense* Forest (CEGL008513).
- *Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest (CEGL006109).
- *Tsuga canadensis - Betula alleghaniensis - Prunus serotina / Rhododendron maximum* Forest (CEGL006206).
- *Tsuga canadensis - Halesia tetraptera - (Fagus grandifolia, Magnolia fraseri) / Rhododendron maximum / Dryopteris intermedia* Forest (CEGL007693).

Related Concepts:

- *Betula alleghaniensis - Tsuga canadensis - (Picea rubens) / Rhododendron maximum* Forest (Fleming and Coulling 2001) =
- *Betula alleghaniensis - Tsuga canadensis / Rhododendron maximum* Forest (Fleming et al. 2006) =

- *Betula alleghaniensis / Oxalis montana* Association: *Betula alleghaniensis / Rhododendron maximum* Variant (Fleming and Moorhead 1996) ?
- *Betula alleghaniensis / Rhododendron maximum* forest (Vanderhorst 2001b) =
- Hemlock - Yellow Birch: 24 (Eyre 1980) B
- High-Elevation Cove Forest (Fleming and Coulling 2001) B
- Red Spruce Community: Hemlock - Spruce Subtype (Adams and Stephenson 1991) ?

SOURCES

Description Authors: G. Fleming and P. Coulling, mod. S. Gawler and K. Patterson.

References: Adams and Stephenson 1991, Eyre 1980, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming and Patterson 2009a, Fleming et al. 2001, Fleming et al. 2006, Grafton and McGraw 1976, Livingston and Mitchell 1976, NatureServe Ecology - Southeastern U.S. unpubl. data, Newell 1997, Newell et al. 1997, Peet et al. unpubl. data 2002, Southeastern Ecology Working Group n.d., TDNH unpubl. data, VDNH 2003, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2010.

Plot GARI.159. Yellow Birch Cold Cove Forest.

COMMON NAME (PARK-SPECIFIC): EASTERN HEMLOCK - OAK - SWEET BIRCH / GREAT LAUREL FOREST

SYNONYMS

USNVC English Name: **Tuliptree - Sweet Birch - Eastern Hemlock / Great Laurel Forest**

USNVC Scientific Name: ***Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest**

USNVC Identifier: **CEGL007543**

LOCAL INFORMATION

Environmental Description: This matrix forest dominates colluvial gorge slopes of all aspects in the eastern two-thirds of the park. Landscape dominance of *Tsuga canadensis* (eastern hemlock) in GARI is a reflection of the area's temperate climate with relatively high rainfall combined with the preponderance of well-drained coarse-textured acidic soils derived primarily from sandstone. Mean solar exposure of mapped stands is relatively low but values have a high standard deviation. Slopes in mapped polygons range from 0 to 55 degrees (mean = 22.7). Elevations in mapped polygons range from 207 to 611 m (mean = 416). Bedrock geology is mapped as primarily sandstones of the New River and Kanawha formations in the Pottsville group. Unvegetated ground cover in plots is dominated by litter, with high cover of large rocks in several plots. Soils in plots are described as well-drained, dry to moist loam, sandy loam, sandy clay loam, and silt loam. Soils test strongly to extremely acidic (mean pH = 4.17) with relatively high levels of total exchange capacity and estimated N release, and relatively low levels of Ca, Cu, Mg, Mn, and Zn compared to average values from all plots in the park. Adjacent vegetation often occurs as smaller patches embedded within a matrix of this association. Adjacent associations include Oak / Great Laurel Forest (CEGL006286), Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222), Oak - Hickory - Sugar Maple Forest (CEGL007268), Yellow Birch Cold Cove Forest (CEGL007861), and Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest (CEGL008524). Eastern Hemlock Plateau Forest (CEGL006304) often occurs uphill from this association on residual soils of upper slopes and plateaus.

Vegetation Description: This association represents mixed evergreen-deciduous forests codominated by *Tsuga canadensis* (eastern hemlock) with a well-developed shrub layer dominated by *Rhododendron maximum* (great laurel). Canopies are tall (>20 m) with cover in plots ranging from 50 to 100%. Codominant canopy trees include (in decreasing order of constancy in plots) *Tsuga canadensis* (eastern hemlock), *Acer rubrum* (red maple), *Quercus rubra* (northern red oak), *Betula lenta* (sweet birch), *Quercus prinus* (chestnut oak), *Liriodendron tulipifera* (tuliptree), *Fagus grandifolia* (American beech), and *Magnolia fraseri* (mountain magnolia). Cover in the subcanopy of plots ranges from 10 to 50%. In addition to the canopy species, the subcanopy also includes *Oxydendrum arboreum* (sourwood), *Nyssa sylvatica* (blackgum), *Ilex opaca* var. *opaca* (American holly), and *Magnolia tripetala* (umbrella-tree). The shrub layers are usually very well-developed and strongly dominated by *Rhododendron maximum* (great laurel). Additional species in the shrub layers of plots include *Ilex opaca* var. *opaca* (American holly), *Hamamelis virginiana* (American witchhazel), *Smilax rotundifolia* (roundleaf greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), and *Kalmia latifolia* (mountain laurel). There is low to moderate cover and diversity

in the herb layer. Common herbs include *Polystichum acrostichoides* (Christmas fern), *Mitchella repens* (partridgeberry), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Viola blanda* (sweet white violet), *Polypodium virginianum* (rock polypody), *Monotropa uniflora* (Indianpipe), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), and *Hexastylis virginica* (Virginia heartleaf). Vascular plant species diversity in plots ranges from 7 to 33 taxa (mean = 19.5). Bryophytes identified in plots include *Leucobryum glaucum* (leucobryum moss), *Thuidium delicatulum* (delicate thuidium moss), *Hypnum imponens* (hypnum moss), *Bazzania trilobata* (common bazzania liverwort), *Dicranum scoparium* (dicranum moss), *Dicranum fulvum* (dicranum moss), *Brotherella recurvans* (recurved brotherella moss), and *Polytrichum pallidisetum* (polytrichum moss).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	S5	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association is the matrix forest on gorge slopes of all aspects in the eastern two-thirds of GARI but becomes restricted to more mesic positions in the western third of the park.
Classification Comments: Stands of this association at GARI often have a larger component of *Quercus* (oak) species compared to stands at New River Gorge National River (NERI). At NERI, this association includes deciduous forests dominated by *Betula lenta* (sweet birch), *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), and *Quercus rubra* (northern red oak) with high cover by *Rhododendron maximum* (great laurel) in the shrub layers. However, at GARI, deciduous forests with high *Rhododendron maximum* (great laurel) cover have a larger component of *Quercus prinus* (chestnut oak) and other oaks, and generally lack *Liriodendron tulipifera* (tuliptree); these forests at GARI are classified as Oak / Great Laurel Forest (CEGL006286).
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Twenty-two plots were sampled: GARI.36, GARI.51, GARI.52, GARI.60, GARI.71, GARI.76, GARI.78, GARI.95, GARI.103, GARI.106, GARI.113, GARI.131, GARI.132, GARI.137, GARI.140, GARI.150, GARI.158, GARI.186, GARI.196, GARI.204, GARI.205, and GARI.208.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	*Tsuga canadensis - Liriodendron tulipifera* Forest Alliance (A.413)
Alliance (English name)	Eastern Hemlock - Tuliptree Forest Alliance
Association	*Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest

Association (English name) Tuliptree - Sweet Birch - Eastern Hemlock / Great Laurel Forest
Ecological System(s): Southern and Central Appalachian Cove Forest (CES202.373).

GLOBAL DESCRIPTION

Concept Summary: This association includes hemlock-hardwood forests and acidic cove forests of lower to intermediate elevations in the Southern Blue Ridge, upper Piedmont, Cumberlands, and adjacent areas, ranging from southwestern Virginia and southern West Virginia, south and west to northwestern Georgia. The concept for this association is intended to be broad and cover both mixed stands of evergreen and deciduous hardwoods as well as stands dominated exclusively by deciduous trees in mesic, acidic environments. These communities occur at low to middle elevations (200–1060 m [650–3500 ft]), generally in coves, gorges or sheltered slopes, over acidic soils. The canopy is usually dominated by *Liriodendron tulipifera* (tuliptree) or *Betula lenta* (sweet birch) mixed with *Tsuga canadensis* (eastern hemlock), but substantial portions may be comprised mainly of *Tsuga canadensis* (eastern hemlock) and the occasional *Acer rubrum* (red maple), while other sites may have little or no *Tsuga* (hemlock) in the canopy. Other deciduous species more typical of "rich" coves may occur as scattered individuals, including *Tilia americana* var. *heterophylla* (American basswood), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), and *Fagus grandifolia* (American beech). Other canopy/subcanopy species often include *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Magnolia fraseri* (mountain magnolia), and *Pinus strobus* (eastern white pine). *Rhododendron maximum* (great laurel) is usually dominant in the shrub stratum, often forming impenetrable thickets. South of Virginia, woody associates may also include *Ilex opaca* var. *opaca* (American holly), *Calycanthus floridus* (eastern sweetshrub), *Halesia tetraptera* var. *tetraptera* (mountain silverbell), and *Leucothoe fontanesiana* (highland doghobble). Herbaceous cover is sparse but can be diverse and is composed of acid-loving species. Typical herbs include *Polystichum acrostichoides* (Christmas fern), *Dryopteris intermedia* (intermediate woodfern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Goodyera pubescens* (downy rattlesnake plantain), *Mitchella repens* (partridgeberry), *Thelypteris noveboracensis* (New York fern), *Galax urceolata* (beetleweed), *Viola rotundifolia* (roundleaf yellow violet), and *Tiarella cordifolia* (heartleaf foamflower).

Environmental Description: This association is typically found at lower to intermediate elevations (200–1060 m [650–3500 ft]) in the Southern Appalachians and adjacent foothills as well as nearby plateau/gorge systems in West Virginia. Habitats are mesic and located on gentle to steep, lower slopes along creeks in ravines, in coves or gorges, and in concave positions on protected slopes with cool aspects and acidic soils. In situations where midslopes are in protected north-facing positions, this community can range very high up straight or even convex slopes. The type often occurs in linear patches along stream bottoms and in steep ravines in complexes with rich cove communities. Although frequently associated with streams, it is not a wetland. Soils collected from plots are extremely acidic (mean pH = 4.0) and infertile, with high iron and aluminum levels and very low total base saturation. Where present, they are usually well-drained sandy loam, silt loam, loam, clay loam, or clay. The degree of soil development is highly variable. Some stands have relatively deep colluvial or residual soils, while others have a substrate of deeply piled boulders with sparse interstitial, organic soils.

Vegetation Description: This association encompasses hemlock-hardwood forests and acidic cove forests with canopies dominated by mixtures of *Tsuga canadensis* (eastern hemlock), *Liriodendron tulipifera* (tuliptree), *Betula lenta* (sweet birch), *Quercus rubra* (northern red oak), and *Acer rubrum* (red maple). The concept for this association is intended to be broad and cover

both mixed stands of evergreen and deciduous hardwoods as well as stands dominated exclusively by deciduous trees. Presumably because of past logging, *Tsuga canadensis* (eastern hemlock) is absent or confined to the understory in some stands, which have mixed canopies of *Liriodendron tulipifera* (tuliptree), *Betula lenta* (sweet birch), *Acer rubrum* (red maple), *Magnolia acuminata* (cucumber-tree), *Quercus rubra* (northern red oak), and/or *Nyssa sylvatica* (blackgum). Other deciduous species more typical of fertile coves, including *Tilia americana* var. *heterophylla* (American basswood), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), and *Fagus grandifolia* (American beech), may occur as scattered individuals. Minor overstory and understory species include *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Magnolia fraseri* (mountain magnolia), *Magnolia tripetala* (umbrella-tree), *Oxydendrum arboreum* (sourwood), *Prunus serotina* (black cherry), and *Pinus strobus* (eastern white pine). *Rhododendron maximum* (great laurel) is scattered to dominant in the shrub stratum often forming nearly impenetrable colonies. *Kalmia latifolia* (mountain laurel) is also a typical, but less abundant, shrub. In the southern portion of this type's range, *Calycanthus floridus* (eastern sweetshrub), *Halesia tetraptera* (mountain silverbell), and *Leucothoe fontanesiana* (highland doghobble) may be common; these are lacking in Virginia and West Virginia occurrences, where *Hamamelis virginiana* (American witchhazel) and *Acer pensylvanicum* (striped maple) may be minor associates. Herbaceous cover is sparse but can be diverse and is composed of acid-loving species. Frequent low-cover species of this layer include *Arisaema triphyllum* (Jack in the pulpit), *Chimaphila maculata* (striped prince's pine), *Dioscorea quaternata* (fourleaf yam), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Eurybia divaricata* (white wood aster), *Galax urceolata* (beetleweed), *Gaultheria procumbens* (eastern teaberry), *Goodyera pubescens* (downy rattlesnake plantain), *Hexastylis* (heartleaf) spp., *Luzula echinata* (hedgehog woodrush), *Monotropa uniflora* (Indianpipe), *Medeola virginiana* (Indian cucumber), *Mitchella repens* (partridgeberry), *Polypodium virginianum* (rock polypody), *Polystichum acrostichoides* (Christmas fern), *Thelypteris noveboracensis* (New York fern), *Tiarella cordifolia* (heartleaf foamflower), *Viola blanda* (sweet white violet), and *Waldsteinia fragarioides* (Appalachian barren strawberry). The spectacular sedge *Cymophyllus fraserianus* (Fraser's cymophyllus) is often associated with this forest. Bryophytes identified in West Virginia plots include *Leucobryum glaucum* (leucobryum moss), *Thuidium delicatulum* (delicate thuidium moss), *Hypnum imponens* (hypnum moss), *Bazzania trilobata* (common Bazzania liverwort), *Dicranum scoparium* (dicranum moss), *Dicranum fulvum* (dicranum moss), *Brotherella recurvans* (recurved brotherella moss), and *Polytrichum pallidisetum* (polytrichum moss).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
		Betula lenta (sweet birch)
		Liriodendron tulipifera (tuliptree)
Tall shrub/sapling	Broad-leaved evergreen tree	*Rhododendron maximum* (great laurel)

Characteristic Species: *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Galax urceolata* (beetleweed), *Leucothoe fontanesiana* (highland doghobble), *Liriodendron tulipifera* (tuliptree), *Luzula echinata* (hedgehog woodrush), *Mitchella repens* (partridgeberry), *Polystichum acrostichoides* (Christmas fern), *Quercus rubra* (northern red oak), *Rhododendron maximum* (great laurel), *Thelypteris noveboracensis* (New York fern), *Tiarella cordifolia*

(heartleaf foamflower), *Tsuga canadensis* (eastern hemlock), *Waldsteinia fragarioides* (Appalachian barren strawberry).

Other Noteworthy Species:

Species	GRank	Type	Note
Ageratina altissima var. *roanensis* (white snakeroot)	G5T3T4	plant	
Betula uber (Virginia roundleaf birch)	G1Q	plant	Federally listed threatened; globally critically imperiled
Botrychium jenmanii (Dixie grapefern)	G3G4	plant	
Diervilla rivularis (mountain bush honeysuckle)	G3	plant	
Hexastylis contracta (mountain heartleaf)	G3	plant	
Hexastylis naniflora (dwarfflower heartleaf)	G3	plant	Federally listed threatened
Hexastylis rhombiformis (North Fork heartleaf)	G2	plant	globally imperiled
Isotria medeoloides (green fiveleaf orchid)	G2	plant	Federally listed threatened; globally imperiled
Malaxis bayardii (Bayard's adder's-mouth orchid)	G1G2	plant	globally imperiled
Monotropsis odorata (pygmypipes)	G3	plant	
Shortia galacifolia var. *brevistyla* (Oconee bells)	G2G3T2	plant	globally imperiled
Shortia galacifolia var. *galacifolia* (Oconee bells)	G2G3T2T3	plant	
Trillium persistens (persistent wakerobin)	G1	plant	Federally listed endangered; globally critically imperiled
Trillium pusillum var. 1 (interior least trillium)	G3T2Q	plant	globally imperiled
Trillium rugelii (illscented wakerobin)	G3	plant	
Vaccinium hirsutum (hairy blueberry)	G3	plant	
Waldsteinia lobata (Piedmont barren strawberry)	G2G3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge and Cumberlands and peripherally in the upper Piedmont and southern Central Appalachians, ranging from southwestern Virginia and southeastern West Virginia south and west to northwestern Georgia.

States/Provinces: GA, NC, SC, TN, VA:S4S5, WV:S5.

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Appalachian Trail, Blue Ridge Parkway, Bluestone, Carl Sandburg Home, Gauley River, Great Smoky Mountains, New River Gorge, Obed); USFS (Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Cherokee, Jefferson, Nantahala, Pisgah, Sumter, Sumter (Mountains), Sumter (Piedmont)).

CONSERVATION STATUS

Rank: G5 (27-Sep-2004).

Reasons: Within its range, this community type occurs extensively in suitable mesic habitats. Occurrences are subject to compositional modification by outbreaks of hemlock woolly adelgid (*Adelges tsugae*), an exotic insect pest that causes decline and eventual mortality of *Tsuga canadensis* (eastern hemlock).

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 1 - Strong.

Comments: Deciduous trees more typical of "rich" coves, such as *Aesculus flava* (yellow buckeye), *Tilia americana* var. *heterophylla* (American basswood), and *Acer saccharum* (sugar maple), are present in this forest only as minor components, if at all. Likewise, rich-site herbs such as *Actaea racemosa* (black bugbane), *Caulophyllum thalictroides* (blue cohosh), *Actaea pachypoda* (white baneberry), and *Adiantum pedatum* (northern maidenhair) are absent or nearly

so. This forest is distinguished from "northern hardwood forests" by the lack of or near absence of *Fagus grandifolia* (American beech), *Betula alleghaniensis* (yellow birch), and *Aesculus flava* (yellow buckeye), and the presence of low-elevation species such as *Betula lenta* (sweet birch) and *Liriodendron tulipifera* (tuliptree), and generally by a more depauperate herb layer. There is much variability in species composition in the 43 plots classified as this association from the Appalachian Trail region (Fleming and Patterson 2009a), but constancy of the nominal species was quite high ($\geq$84%). The most constant species ($\geq$64%), in order of descending constancy, are *Rhododendron maximum* (great laurel), *Tsuga canadensis* (eastern hemlock), *Betula lenta* (sweet birch), *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Quercus rubra* (northern red oak), *Mitchella repens* (partridgeberry), *Polystichum acrostichoides* (Christmas fern), and *Hamamelis virginiana* (American witchhazel). Species richness in 400-m^2 plots ranges from 11–72 species per plot. This variable richness is probably influenced by somewhat variable soil fertility and the variation in cover/density of evergreen *Rhododendron* (rhododendron) shrub colonies. An interesting example from the Piedmont/Blue Ridge transition of Georgia (Cedar Creek Canyon, Chattahoochee National Forest) has high coverage of *Rhododendron minus* (piedmont rhododendron) and other foothills/Piedmont species such as *Liquidambar styraciflua* (sweetgum) and *Aesculus sylvatica* (painted buckeye).

In the 900- to 1060-m (3000-3500 ft) elevational range, the type becomes transitional to *Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / (Leucothoe fontanesiana)* Forest (CEGL007861), which lacks lower-elevation species such as *Liriodendron tulipifera* (tuliptree) and *Galax urceolata* (beetleweed), and contains many species characteristic of higher elevations and northern latitudes.

Similar vegetation has been observed in coves of the Cumberland Mountains of southwestern Virginia (e.g., Clinch Ranger District: Dark Hollow, Roaring Branch, Pick Breeches, and Flannery Ridges) but comprehensive data are needed to determine whether these stands are part of this forest type or transitional to *Tsuga canadensis - (Fagus grandifolia, Tilia americana* var. *heterophylla) / Magnolia tripetala* Forest (CEGL008407). The latter unit apparently has an extensive distribution in the Cumberland Plateau of Kentucky and Tennessee, the Southern Ridge and Valley of Tennessee, and the Central Appalachians of West Virginia and southwestern Pennsylvania.

Similar Associations:

- *Acer rubrum* var. *rubrum - Betula (alleghaniensis, lenta) - Magnolia fraseri / (Rhododendron maximum, Kalmia latifolia)* Forest (CEGL008558).
- *Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / (Leucothoe fontanesiana)* Forest (CEGL007861).
- *Pinus strobus - Tsuga canadensis / Rhododendron maximum - (Leucothoe fontanesiana)* Forest (CEGL007102).
- *Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest (CEGL006286).
- *Tsuga canadensis - (Fagus grandifolia, Tilia americana* var. *heterophylla) / Magnolia tripetala* Forest (CEGL008407).
- *Tsuga canadensis - (Pinus strobus)* Temporarily Flooded Forest (CEGL007143).
- *Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana, Kalmia latifolia)* Forest (CEGL005043).
- *Tsuga canadensis - Halesia tetraptera - (Fagus grandifolia, Magnolia fraseri) / Rhododendron maximum / Dryopteris intermedia* Forest (CEGL007693).
- *Tsuga canadensis - Quercus prinus - Liriodendron tulipifera / Kalmia latifolia - (Rhododendron catawbiense)* Forest (CEGL008512).

Related Concepts:

- *Liriodendron tulipifera - Betula lenta - (Tsuga canadensis) / Rhododendron maximum / Galax urceolata* Forest (Fleming et al. 2006) =
- *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (Fleming and Coulling 2001) ?
- *Tsuga canadensis - Betula lenta / Rhododendron maximum* forest (Vanderhorst 2001b) =
- Acidic Cove Forest (Fleming et al. 2001) B
- Acidic Cove Forest (Typic Subtype) (Schafale 1998b) ?
- Cove Forest (Patterson et al. 1994) B
- IA5b. Southern Appalachian Hemlock Cove Forest (Allard 1990) B
- Mixed Mesophytic Coves (Gettman 1974) ?
- Sweet Birch - Hemlock Type (Schmalzer and DeSelm 1982) =
- Type 5 (Newell and Peet 1995) ?
- Yellow-Poplar - Eastern Hemlock: 58 (Eyre 1980) B

SOURCES

Description Authors: K. Patterson, mod. G. Fleming and P. Coulling, mod. T. Govus and S. Gawler.

References: Allard 1990, Eyre 1980, Fleming and Coulling 2001, Fleming and Patterson 2009a, Fleming et al. 2001, Fleming et al. 2004, Fleming et al. 2006, Gettman 1974, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Newell and Peet 1995, Patterson 1994, Patterson et al. 1994, Peet et al. unpubl. data 2002, Perez pers. comm., Schafale 1998b, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2008, Vanderhorst et al. 2010, Wood 1999.

Plot GARI.36. Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest.

COMMON NAME (PARK-SPECIFIC): AMERICAN SYCAMORE - RIVER BIRCH RIVERSCOUR WOODLAND

SYNONYMS

USNVC English Name: **American Sycamore - River Birch / Silky Dogwood / (Big Bluestem, River-oats) Woodland**

USNVC Scientific Name: ***Platanus occidentalis - Betula nigra / Cornus amomum / (Andropogon gerardii, Chasmanthium latifolium)* Woodland**

USNVC Identifier: **CEGL003725**

LOCAL INFORMATION

Environmental Description: This association occurs in small patches and linear zones in positions along rivershores subject to frequent, high-energy flooding. Floods damage and remove trees, maintaining a short, open canopy. Slopes in mapped polygons range from 3 to 39 degrees (mean = 19.6). Elevations in mapped polygons range from 207 to 421 m (mean = 274.6). On depositional landforms, variation in flooding frequency and intensity is expressed in sediment particle size, ranging from boulders and cobbles in areas subject to the most frequent, highest energy floods to stone-free sand in areas subject to less frequent, lower energy floods. In GARI, this association also occurs on flood-scoured bedrock. Unvegetated ground cover in plots is usually dominated by large rock or sand, but significant bedrock and flotsam occur in some plots. There is often a range in soil drainage related to microsites and bank position. Soils in plots are described as temporarily flooded, moderately well- to rapidly-drained sand and sandy loam. Soils test very slightly to very strongly acidic (mean pH = 5.29) with relatively high levels of Mn, and relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, B, Ca, Cu, K, Na, and P compared to average values from all plots in the park. Adjacent associations include Riverscour Shrub Prairie (CEGL006623), which occurs in areas subject to more frequent, higher energy flooding, and Oak - Hickory Floodplain Forest (CEGL006462), Eastern Hemlock Floodplain Forest (CEGL006620), and American Sycamore - Tuliptree - Sweetgum Floodplain Forest (CEGL004418), which occur in less frequently flooded positions.
Vegetation Description: This association is a deciduous woodland dominated by *Betula nigra* (river birch) and/or *Platanus occidentalis* (American sycamore). Tree canopies are typically short (<15 m) and open, and trees are often flood-battered and lean downstream. Canopy cover in plots ranges from 10 to 70% and subcanopy cover ranges from 0 to 40%. Distinguishing canopy and shrub strata is often difficult or arbitrary due to short stature and high variability of individual tree heights. At GARI, *Betula nigra* (river birch) is the leading dominant, probably due to acidic soils which are not ideal for *Platanus occidentalis* (American sycamore). Additional important trees in plots include *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Diospyros virginiana* (common persimmon), and *Tsuga canadensis* (eastern hemlock). There is often a well-developed shrub layer composed of heavily battered trees, tree saplings, and true shrubs. Common shrubs in plots include *Ilex verticillata* (common winterberry), *Cornus amomum* (silky dogwood), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), *Alnus serrulata* (hazel alder), *Viburnum nudum* var. *cassinoides* (withe-rod), *Kalmia latifolia* (mountain laurel), *Rhododendron arborescens* (smooth azalea), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), *Vaccinium corymbosum* (highbush blueberry), and *Xanthorhiza simplicissima* (yellowroot). This association is the primary habitat for the threatened shrub *Spiraea virginiana* (Virginia meadowsweet) at GARI. The vine

Toxicodendron radicans (eastern poison ivy) has high constancy in plots. There is usually moderate to high cover and high diversity in the herb layer. Common herbs include (in decreasing order of constancy in plots) *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), *Dichanthelium clandestinum* (deertongue), *Trautvetteria caroliniensis* var. *caroliniensis* (Carolina bugbane), *Eupatorium fistulosum* (trumpetweed), *Osmunda regalis* var. *spectabilis* (royal fern), *Andropogon gerardii* (big bluestem), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Deschampsia flexuosa* (wavy hairgrass), *Solidago rugosa* (wrinkleleaf goldenrod), and *Packera paupercula* (balsam groundsel). Stands on sandy alluvium may have high cover by *Chasmanthium latifolium* (Indian woodoats). Vascular plant species richness in plots ranges from 41 to 76 taxa (mean = 53). Nonvascular cover is usually low but may range up to 20%, mostly on rocks. Bryophytes identified in more than one plot include *Schistidium apocarpum*, *Grimmia laevigata* (grimmia dry rock moss), *Climacium americanum* (American climacium moss), *Bryoandersonia illecebra* (bryoandersonia moss), and *Sphagnum lescurii* (Lescur's sphagnum). Lichens identified in plots include *Coccocarpia palmicola* and *Dermatocarpon luridum*.

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association occurs in small patches scattered throughout the length of the Meadow and Gauley rivers in the park.

Classification Comments: One stand of this association (sampled by plot GARI.90) clusters with and is remarkably similar to stands of this association at Bluestone National Scenic River (BLUE) that were recognized as a river birch / Indian woodoats phase (Vanderhorst et al. 2008). These stands occur on sandy alluvium, are strongly dominated by *Betula nigra* (river birch), and have understories dominated by *Dichanthelium clandestinum* (deertongue), *Chasmanthium latifolium* (Indian woodoats), and tall herbs. Most other plots of this association at GARI cluster as a sister clade to the group of plots representing Riverscour Shrub Prairie (CEGL006623) at GARI, rather than directly with plots of CEGL003725 from BLUE or New River Gorge National River (NERI) (Vanderhorst et al. 2007). This is due to a large number of riparian species that are common at GARI but absent or sparse at BLUE and NERI; these include *Ilex verticillata* (common winterberry), *Rhododendron arborescens* (smooth azalea), *Xanthorhiza simplicissima* (yellowroot), *Packera paupercula* (balsam groundsel), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Osmunda regalis* var. *spectabilis* (royal fern), and others. However, there are also floristic differences, in addition to contrasting physiognomy, which help distinguish CEGL003725 and CEGL006623 at GARI. In a previous study of riparian communities at GARI, Walton and Anderson (1997) described a *Betula nigra - Platanus occidentalis / Xanthorhiza simplicissima* woodland which is equivalent to this association. Plot data collected for their study were incorporated in this analysis, and plots of their *Liquidambar styraciflua - Carpinus caroliniana* woodland (GARI.29, GARI.30) were also attributed to this association.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Twenty-three plots were sampled: GARI.1, GARI.2, GARI.10, GARI.13, GARI.17, GARI.21, GARI.22, GARI.23, GARI.24, GARI.29, GARI.30, GARI.32, GARI.40, GARI.47,

GARI.67, GARI.90, GARI.91, GARI.97, GARI.100, GARI.108, GARI.109, GARI.117, and GARI.128.
Gauley River National Recreation Area Inventory Notes: All ten randomly placed accuracy assessment points for the Riparian Zone map class were keyed to Riverscour Shrub Prairie (CEGL006623), therefore American Sycamore - River Birch Riverscour Woodland (CEGL003725) is probably not a large component of this map class.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Woodland (II)
Physiognomic Subclass	Deciduous woodland (II.B.)
Physiognomic Group	Cold-deciduous woodland (II.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous woodland (II.B.2.N.)
Formation	Temporarily flooded cold-deciduous woodland (II.B.2.N.b.)
Alliance	*Platanus occidentalis - (Betula nigra, Salix* spp.) Temporarily Flooded Woodland Alliance (A.633)
Alliance (English name)	American Sycamore - (River Birch, Willow species) Temporarily Flooded Woodland Alliance
Association	*Platanus occidentalis - Betula nigra / Cornus amomum / (Andropogon gerardii, Chasmanthium latifolium)* Woodland
Association (English name)	American Sycamore - River Birch / Silky Dogwood / (Big Bluestem, River-oats) Woodland
Ecological System(s):	South-Central Interior Large Floodplain (CES202.705). South-Central Interior Small Stream and Riparian (CES202.706).

GLOBAL DESCRIPTION

Concept Summary: These woodlands occur along high-energy Appalachian rivershores, such as along the New, Bluestone, and Gauley rivers in West Virginia. They maintain an open canopy due to mechanical disturbance (flooding and scouring). The coarse-textured substrates are potentially well-drained, but fluvial topography and proximity to the water table often result in a mixture of well-drained and poorly drained microsites. The usually short, open canopy is composed mostly of flood-battered trees, typically codominated by *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch). The tallest trees are often the younger ones which have not yet been subjected to damage by severe floods. Additional important trees include *Acer saccharinum* (silver maple), *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Catalpa speciosa* (northern catalpa), *Diospyros virginiana* (common persimmon), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Nyssa sylvatica* (blackgum), *Robinia pseudoacacia* (black locust), *Salix nigra* (black willow), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). *Tsuga canadensis* (eastern hemlock) is present in some sites along the Gauley River. Common shrubs include *Alnus serrulata* (hazel alder), *Cephalanthus occidentalis* (common buttonbush), *Chionanthus virginicus* (white fringetree), *Cornus amomum* (silky dogwood), *Hypericum prolificum* (shrubby St. Johnswort), *Ilex verticillata* (common winterberry), *Lindera benzoin* (northern spicebush), *Physocarpus opulifolius* (common ninebark), *Salix caroliniana* (coastal plain willow), and *Xanthorhiza simplicissima* (yellowroot). The invasive exotic shrub *Rosa multiflora* (multiflora rose) is sometimes present. There is often a large component of woody vines in the short-shrub layer, including *Campsis radicans* (trumpet creeper), *Toxicodendron radicans* (eastern poison ivy), and *Vitis rupestris* (sand grape). The herb layer is composed of a mixture of warm-season grasses and forbs adapted to frequent flooding and high light exposure. Characteristic herbs

include *Andropogon gerardii* (big bluestem), *Apocynum cannabinum* (Indianhemp), *Baptisia australis* (blue wild indigo), *Chasmanthium latifolium* (Indian woodoats), *Conoclinium coelestinum* (blue mistflower), *Cryptotaenia canadensis* (Canadian honewort), *Deschampsia flexuosa* (wavy hairgrass), *Dichanthelium clandestinum* (deertongue), *Eupatorium fistulosum* (trumpetweed), *Galium triflorum* (fragrant bedstraw), *Justicia americana* (American water-willow), *Lobelia cardinalis* (cardinalflower), *Lysimachia ciliata* (fringed loosestrife), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* var. *spectabilis* (royal fern), *Packera aurea* (golden ragwort), *Packera paupercula* (balsam groundsel), *Panicum virgatum* (switchgrass), *Pilea pumila* (Canadian clearweed), *Rudbeckia laciniata* (cutleaf coneflower), *Solidago gigantea* (giant goldenrod), *Solidago juncea* (early goldenrod), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Symphyotrichum prenanthoides* (crookedstem aster), *Tradescantia ohiensis* (bluejacket), *Trautvetteria caroliniensis* (Carolina bugbane), *Tripsacum dactyloides* (eastern gamagrass), *Verbesina alternifolia* (wingstem), and *Viola cucullata* (marsh blue violet). Exotic herbs which are common, usually in small amounts, include *Prunella vulgaris* (common selfheal), *Plantago rugelii* (blackseed plantain), *Trifolium pratense* (red clover), *Melilotus officinalis* (yellow sweetclover), *Lysimachia nummularia* (creeping jenny), and *Coronilla varia* (purple crownvetch).

Environmental Description: These woodlands occur along high-energy Appalachian rivershores, such as the New River in West Virginia. They maintain an open canopy due to mechanical disturbance (flooding and scouring). This association occurs as relatively continuous linear zones (sometimes in small patches), commonly on deposition bars, in positions that are subject to frequent high-energy flooding. These floods damage and remove trees, maintaining an open canopy. Variation in this community related to flooding frequency and intensity is expressed in sediment particle size, ranging from boulders and cobbles in areas subject to the most frequent, highest energy floods to stone-free silty sand in areas subject to less frequent, lower energy floods. There is no soil horizon development. These coarse-textured substrates are potentially well-drained, but fluvial topography and proximity to the water table often result in a mixture of well-drained and poorly drained microsites. Unvegetated ground cover is dominated by various mixtures of boulders, cobbles, and sand, with significant cover by coarse woody debris (flotsam) and standing water in some plots. Soil chemistry analyzed from 27 West Virginia plots indicates low levels of macronutrients (N, P, K) and organic matter, and high levels of several micronutrients (Fe, Mg, Mn, Zn, somewhat variable from site to site). Plots along the New River have soils with relatively high pH (mean = 6.73), while those along the Bluestone and Gauley rivers are more acidic (mean pH = 5.6 and 5.3, respectively). Slopes range from level to steep but are generally gentle. Known elevations range from 207 to 485 m (670–1575 ft).

Vegetation Description: This association is a deciduous woodland with a short, open canopy (10–70% cover) typically codominated by flood-battered *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch). Additional important trees include *Acer saccharinum* (silver maple), *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Catalpa speciosa* (northern catalpa), *Diospyros virginiana* (common persimmon), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Nyssa sylvatica* (blackgum), *Robinia pseudoacacia* (black locust), *Salix nigra* (black willow), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). *Tsuga canadensis* (eastern hemlock) is present in some sites along the Gauley River. The tallest trees are often the younger ones which have not yet been subjected to damage by severe floods. Common shrubs include *Alnus serrulata* (hazel alder), *Cephalanthus*

occidentalis (common buttonbush), *Chionanthus virginicus* (white fringetree), *Cornus amomum* (silky dogwood), *Hypericum prolificum* (shrubby St. Johnswort), *Ilex verticillata* (common winterberry), *Lindera benzoin* (northern spicebush), *Physocarpus opulifolius* (common ninebark), *Salix caroliniana* (coastal plain willow), and *Xanthorhiza simplicissima* (yellowroot). This association is the primary habitat for the threatened shrub *Spiraea virginiana* (Virginia meadowsweet) along the Gauley River. Some Gauley River sites have *Kalmia latifolia* (mountain laurel), *Rhododendron arborescens* (smooth azalea), and *Vaccinium corymbosum* (highbush blueberry), but heaths are not typical. The invasive exotic shrub *Rosa multiflora* (multiflora rose) is sometimes present. There is often a large component of woody vines in the short-shrub layer, including *Campsis radicans* (trumpet creeper), *Toxicodendron radicans* (eastern poison ivy), and *Vitis rupestris* (sand grape). The herb layer is composed of a mixture of warm-season grasses and forbs adapted to frequent flooding and high light exposure. Characteristic herbs include *Andropogon gerardii* (big bluestem), *Apocynum cannabinum* (Indianhemp), *Baptisia australis* (blue wild indigo), *Chasmanthium latifolium* (Indian woodoats), *Conoclinium coelestinum* (blue mistflower), *Cryptotaenia canadensis* (Canadian honewort), *Deschampsia flexuosa* (wavy hairgrass), *Dichanthelium clandestinum* (deertongue), *Eupatorium fistulosum* (trumpetweed), *Galium triflorum* (fragrant bedstraw), *Justicia americana* (American water-willow), *Lobelia cardinalis* (cardinalflower), *Lysimachia ciliata* (fringed loosestrife), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* var. *spectabilis* (royal fern), *Packera aurea* (golden ragwort), *Packera paupercula* (balsam groundsel), *Panicum virgatum* (switchgrass), *Pilea pumila* (Canadian clearweed), *Rudbeckia laciniata* (cutleaf coneflower), *Solidago gigantea* (giant goldenrod), *Solidago juncea* (early goldenrod), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Symphyotrichum prenanthoides* (crookedstem aster), *Tradescantia ohiensis* (bluejacket), *Trautvetteria caroliniensis* (Carolina bugbane), *Tripsacum dactyloides* (eastern gamagrass), *Verbesina alternifolia* (wingstem), and *Viola cucullata* (marsh blue violet). Exotic herbs which are common in small amounts include *Prunella vulgaris* (common selfheal), *Plantago rugelii* (blackseed plantain), *Trifolium pratense* (red clover), *Melilotus officinalis* (yellow sweetclover), *Lysimachia nummularia* (creeping jenny), and *Coronilla varia* (purple crownvetch). Plants tracked as rare in West Virginia by the Natural Heritage Program include *Baptisia australis* (blue wild indigo), *Carex emoryi* (Emory's sedge), *Coreopsis pubescens* var. *robusta* (star tickseed), *Juncus dichotomus* (forked rush), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Spiraea virginiana* (Virginia meadowsweet), *Stachys tenuifolia* (smooth hedgenettle), and *Vitis rupestris* (sand grape). Vascular plant species richness in the 51 sampled plots in West Virginia ranges from 15 to 87 (mean = 49.5). The bryophyte layer is usually poorly developed; crustose lichens may occur on large rocks. Along the Gauley River, mosses in plots include *Schistidium apocarpum*, *Grimmia laevigata* (grimmia dry rock moss), *Climacium americanum* (American climacium moss), *Bryoandersonia illecebra* (bryoandersonia moss), and *Sphagnum lescurii* (Lescur's sphagnum); lichens identified in plots include *Coccocarpia palmicola* and *Dermatocarpon luridum*.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Betula nigra* (river birch)
		Platanus occidentalis (American sycamore)

Characteristic Species: *Acer rubrum* (red maple), *Acer saccharinum* (silver maple), *Alnus serrulata* (hazel alder), *Andropogon gerardii* (big bluestem), *Apocynum cannabinum* (Indianhemp), *Baptisia australis* (blue wild indigo), *Campsis radicans* (trumpet creeper), *Catalpa speciosa* (northern catalpa), *Cephalanthus occidentalis* (common buttonbush),

Chasmanthium latifolium (Indian woodoats), *Chionanthus virginicus* (white fringetree), *Conoclinium coelestinum* (blue mistflower), *Cornus amomum* (silky dogwood), *Deschampsia flexuosa* (wavy hairgrass), *Dichanthelium clandestinum* (deertongue), *Diospyros virginiana* (common persimmon), *Eupatorium fistulosum* (trumpetweed), *Hypericum prolificum* (shrubby St. Johnswort), *Justicia americana* (American water-willow), *Lobelia cardinalis* (cardinalflower), *Lysimachia ciliata* (fringed loosestrife), *Panicum virgatum* (switchgrass), *Physocarpus opulifolius* (common ninebark), *Robinia pseudoacacia* (black locust), *Salix caroliniana* (coastal plain willow), *Salix nigra* (black willow), *Solidago juncea* (early goldenrod), *Toxicodendron radicans* (eastern poison ivy), *Tripsacum dactyloides* (eastern gamagrass), *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Viola cucullata* (marsh blue violet), *Vitis rupestris* (sand grape).

Other Noteworthy Species:

Species	GRank	Type	Note
Baptisia australis (blue wild indigo)	-	plant	WV state-rare plant
Carex emoryi (Emory's sedge)	-	plant	WV state-rare plant
Coreopsis pubescens var. *robusta* (star tickseed)	-	plant	WV state-rare plant
Coronilla varia (purple crownvetch)	-	plant	exotic
Lysimachia nummularia (creeping jenny)	-	plant	exotic
Melilotus officinalis (yellow sweetclover)	-	plant	exotic
Rosa multiflora (multiflora rose)	-	plant	exotic
Solidago simplex ssp. *randii* var. *racemosa* (Rand's goldenrod)	G5T3?	plant	WV state-rare plant
Spiraea virginiana (Virginia meadowsweet)	G2	plant	Federally listed threatened; globally imperiled
Trifolium pratense (red clover)	-	plant	exotic
Vitis rupestris (sand grape)	G3	plant	WV state-rare plant

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This type is currently documented from high-energy Appalachian rivers, such as the New, Bluestone, and Gauley rivers in West Virginia. Its range may include some of western Virginia as well.

States/Provinces: VA, WV.

Federal Lands: NPS (Bluestone, Gauley River, New River Gorge).

CONSERVATION STATUS

Rank: GNR (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Along the New River, this association is ecologically and floristically intermediate between *Andropogon gerardii - Panicum virgatum - Baptisia australis* Herbaceous Vegetation (CEGL006283), which is more open and occurs on sites which are more severely impacted by flooding, and *Platanus occidentalis - Fraxinus pennsylvanica / Carpinus caroliniana / Verbesina alternifolia* Forest (CEGL006458), which has a more closed canopy, usually lacking *Betula nigra* (river birch), and occurs on sites less severely impacted by flooding. It is also similar to *Salix nigra - Betula nigra / Schoenoplectus pungens* Wooded Herbaceous Vegetation [Provisional] (CEGL006463), which occurs on finer textured alluvium in riverside positions

along lower energy reaches. Similar vegetation was described from the New River Gorge by Suiter (1995) as *Platanus occidentalis - Betula nigra* forest. Two phases of this association can be recognized along the Bluestone River and its tributaries. Stands on cobble and boulder substrate, which are subject to more frequent, higher energy floods, have more open canopies and relatively sparse herb layers with *Andropogon gerardii* (big bluestem) prominent in late season. Stands on sand substrate, which are subject to less frequent, lower energy floods, have taller, more closed canopies, often dominated by *Betula nigra* (river birch), over lush, tall herb layers with abundant *Dichanthelium clandestinum* (deertongue) and *Chasmanthium latifolium* (Indian woodoats). The tough-rooted, flood-tolerant *Carex emoryi* (Emory's sedge) often grows in a line along the riverside edge of this association, sometimes beyond the woodland canopy. These zones are included within the association concept presented here. Recent classification studies in the National Park Service National Capitol Region have shown this association to be distinct from similar vegetation in the Potomac drainage, which is classified as *Platanus occidentalis - Betula nigra - Salix (caroliniana, nigra)* Woodland (CEGL003896).

Similar Associations:

- *(Betula nigra, Ilex verticillata) / Andropogon gerardii - Solidago simplex* ssp. *randii* var. *racemosa* Shrub Herbaceous Vegetation (CEGL006623).
- *Betula nigra - Platanus occidentalis* Forest (CEGL002086)--with a more-or-less closed canopy.
- *Platanus occidentalis - Betula nigra - Salix (caroliniana, nigra)* Woodland (CEGL003896).
- *Quercus bicolor - Fraxinus pennsylvanica - (Platanus occidentalis) / Chasmanthium latifolium - Dichanthelium clandestinum - Zizia aurea* Woodland (CEGL006218).
- *Salix nigra - Betula nigra / Schoenoplectus pungens* Wooded Herbaceous Vegetation [Provisional] (CEGL006463)--occurs in similar riverside positions along lower energy reaches, often just downstream from rapids.

Related Concepts:

- *Betula nigra - Platanus occidentalis / Xanthorhiza simplicissima* woodland (Walton and Anderson 1997) =
- *Platanus occidentalis - Betula nigra / Cornus amomum* riparian woodland (Vanderhorst 2001b) =
- *Platanus occidentalis - Betula nigra* forest (Suiter 1995) ?

SOURCES

Description Authors: M. Pyne, mod. S. C. Gawler.

References: Fleming et al. 2001, Mitchem 2004, Southeastern Ecology Working Group n.d., Suiter 1995, Vanderhorst 2000b, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2008, Vanderhorst et al. 2010, Vanderhorst pers. comm., Walton and Anderson 1997.

Plot GARI.97. American Sycamore - River Birch Riverscour Woodland (sycamore - river birch / big bluestem phase).

Plot GARI.90. American Sycamore - River Birch Riverscour Woodland (river birch / Indian woodoats phase).

COMMON NAME (PARK-SPECIFIC): RIVERSCOUR SHRUB PRAIRIE

SYNONYMS

USNVC English Name:	**(River Birch, Common Winterberry) / Big Bluestem - Sticky Goldenrod Shrub Herbaceous Vegetation**
USNVC Scientific Name:	***(Betula nigra, Ilex verticillata) / Andropogon gerardii - Solidago simplex* var. *racemosa* Shrub Herbaceous Vegetation**
USNVC Identifier:	**CEGL006623**

LOCAL INFORMATION

Environmental Description: This association occurs in small patches and linear zones in positions along rivershores subject to very frequent, high-energy flooding. Flooding disturbance maintains an open physiognomy by removing or damaging trees before they become large enough to provide significant shade. The largest, best developed occurrences are located along rapids created by constrictions in the river channel (bedrock outcrops, point bars, bends, islands, alluvial fans, etc.). Slopes in mapped polygons of the Riparian Zone map class, which includes this association as a major component, range from 0 to 34 degrees (mean = 12). Elevations in mapped polygons of the Riparian Zone map class range from 207 to 512 m (mean = 315). Substrates are primarily sandstone bedrock and boulders. There is often an elevation range of a few meters within stands which creates wet and dry microsites and provides elevated rooting substrate. Bedrock and boulders also provide structure which protects vegetation from high-energy flows. Unvegetated ground cover in most plots is dominated by bedrock and large rocks, but a few plots have higher cover of small rocks and sand. Many plots have some standing water. Soils in plots are described as temporarily flooded, moderately well- to rapidly-drained sand and sandy loam. Soils test strongly to very slightly acidic (mean pH = 5.75) with relatively high levels of Mg, Mn, Na, and Zn, and relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, K, and P compared to average values from all plots in the park. Adjacent vegetation in positions that are subject to somewhat less frequent and less high-energy flooding includes American Sycamore - River Birch Riverscour Woodland (CEGL003725) and (Virginia, Pitch) Pine Floodplain Forest (CEGL006624).

Vegetation Description: This association has mixed shrub and herbaceous physiognomy and may include a few taller trees. All trees in plots are less than 10 m tall and canopy cover in plots ranges from 0 to 30%. Common trees include *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore). Cover in the tall-shrub layer of plots ranges from 0 to 30%, and cover in the short-shrub layer ranges from 0 to 60%. Common species in the shrub layers include (in decreasing order of constancy in plots) *Betula nigra* (river birch), *Platanus occidentalis* (American sycamore), *Ilex verticillata* (common winterberry), *Cornus amomum* (silky dogwood), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), *Rhododendron arborescens* (smooth azalea), *Hypericum prolificum* (shrubby St. Johnswort), *Alnus serrulata* (hazel alder), *Diospyros virginiana* (common persimmon), *Nyssa sylvatica* (blackgum), *Xanthorhiza simplicissima* (yellowroot), *Rosa palustris* (swamp rose), *Cephalanthus occidentalis* (common buttonbush), and *Salix caroliniana* (coastal plain willow). The federally listed threatened shrub *Spiraea virginiana* (Virginia meadowsweet) occurs in three plots and the state-rare shrub *Prunus pumila* (sandcherry) occurs in two plots. Cover in the herb layer of plots ranges from 5 to 60% and this stratum usually has the highest cover. Common herbs include (in decreasing order of constancy in plots) *Andropogon gerardii* (big bluestem), *Solidago simplex*

ssp. *randii* var. *racemosa* (Rand's goldenrod), *Packera paupercula* (balsam groundsel), *Eupatorium fistulosum* (trumpetweed), *Dichanthelium clandestinum* (deertongue), *Symphyotrichum laeve* var. *concinnum* (smooth blue aster), *Sorghastrum nutans* (Indiangrass), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Euphorbia corollata* (flowering spurge), *Clematis virginiana* (devil's darning needles), *Physostegia virginiana* ssp. *virginiana* (obedient plant), *Osmunda regalis* var. *spectabilis* (royal fern), *Viola pedata* (birdfoot violet), *Hypoxis hirsuta* (common goldstar), and *Lysimachia lanceolata* (lanceleaf loosestrife). Additional characteristic herbs include *Ionactis linariifolius* (flaxleaf whitetop aster), *Linum virginianum* (woodland flax), *Zizia aptera* (meadow zizia), *Dichanthelium sphaerocarpon* var. *isophyllum* (roundseed panicgrass), *Marshallia grandiflora* (Monongahela Barbara's buttons), *Liatris scariosa* (devil's bite), and *Baptisia tinctoria* (horseflyweed). Vascular plant species richness in plots ranges from 18 to 70 taxa (mean = 36.4). Nonvascular cover can be high, consisting mostly of bryophytes and lichens on rock. Bryophytes identified in more than one plot include *Porella pinnata* (aquatic tongue liverwort), *Hedwigia ciliata* (ciliate hedwigia moss), *Climacium americanum* (American climacium moss), *Sematophyllum demissum* (sematophyllum moss), *Grimmia laevigata* (grimmia dry rock moss), *Campylopus tallulensis* (Tallul Campylopus moss), and *Fissidens osmundioides* (osmund fissidens moss). Lichens in plots include *Xanthoparmelia conspersa* (xanthoparmelia lichen) and a distinctive "whitewash" growth on the downstream side of boulders, possibly *Phlyctis petraea* or a related species.

Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	*Betula nigra* (river birch)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem) *Sorghastrum nutans* (Indiangrass)

Characteristic Species: *Alnus serrulata* (hazel alder), *Andropogon gerardii* (big bluestem), *Betula nigra* (river birch), *Cephalanthus occidentalis* (common buttonbush), *Clematis virginiana* (devil's darning needles), *Dichanthelium clandestinum* (deertongue), *Diospyros virginiana* (common persimmon), *Eupatorium fistulosum* (trumpetweed), *Euphorbia corollata* (flowering spurge), *Hypericum prolificum* (shrubby St. Johnswort), *Hypoxis hirsuta* (common goldstar), *Ilex verticillata* (common winterberry), *Lysimachia lanceolata* (lanceleaf loosestrife), *Nyssa sylvatica* (blackgum), *Osmunda regalis* var. *spectabilis* (royal fern), *Packera paupercula* (balsam groundsel), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), *Physostegia virginiana* ssp. *virginiana* (obedient plant), *Rhododendron arborescens* (smooth azalea), *Rosa palustris* (swamp rose), *Salix caroliniana* (coastal plain willow), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Sorghastrum nutans* (Indiangrass), *Symphyotrichum laeve* var. *concinnum* (smooth blue aster), *Viola pedata* (birdfoot violet), *Xanthorhiza simplicissima* (yellowroot).

Other Noteworthy Species:

Species	GRank	Type	Note
Marshallia grandiflora (Monongahela Barbara's buttons)	G2	plant	WV state-rare plant (S2)
Packera paupercula (balsam groundsel)	-	plant	WV state-rare plant (S2)
Prunus pumila (sandcherry)	-	plant	WV state-rare plant (S1)
Solidago simplex ssp. *randii* var. *racemosa* (Rand's goldenrod)	G5T3?	plant	WV state-rare plant (S2)
Spiraea virginiana (Virginia meadowsweet)	G2	plant	Fedreally listed threatened; globally imperiled; WV state-rare plant (S1)

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	S2	.	.	[not crosswalked]	.

Local Range: This association occurs in small patches and linear zones scattered throughout the lengths of the Meadow and Gauley rivers in the park.

Classification Comments: In an analysis of riverscour communities throughout West Virginia, plots of this association at Gauley River clustered strongly together as a group distinct from riverscour prairie plots that are classified as *Andropogon gerardii - Panicum virgatum - Baptisia australis* Herbaceous Vegetation (CEGL006283) from New River Gorge National River (Vanderhorst et al. 2007) and the Greenbrier River. They clustered together with plots of shrubby prairies from high-energy reaches of the Tygart's Valley, Middle Fork, and Cheat rivers in north-central West Virginia. These river reaches share acidic sandstone bedrock and boulder substrate and extremely high-energy flows. The "prairie-like situation" described by Bush (1976) describes this vegetation at Arden along the Tygart's Valley River. Similar vegetation may also occur along the Youghiogheny in Pennsylvania. A regional review of similar vegetation from the Potomac to western Pennsylvania and south to the Cumberlands would be instructive to clarify the differences and confirm the correct circumscription of associations.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Twenty-seven plots were sampled: GARI.3, GARI.4, GARI.5, GARI.8, GARI.9, GARI.11, GARI.12, GARI.15, GARI.16, GARI.19, GARI.20, GARI.25, GARI.26, GARI.27, GARI.28, GARI.70, GARI.81, GARI.83, GARI.87, GARI.92, GARI.101, GARI.112, GARI.118, GARI.148, GARI.155, GARI.156, and GARI.173.

Gauley River National Recreation Area Inventory Notes: All ten randomly placed accuracy assessment points for the Riparian Zone map class were keyed to Riverscour Shrub Prairie (CEGL006623), therefore this is probably a large component of this map class.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Temporarily flooded temperate or subpolar grassland (V.A.5.N.j.)
Alliance	*Andropogon gerardii - (Sorghastrum nutans)* Temporarily Flooded Herbaceous Alliance (A.1337)
Alliance (English name)	Big Bluestem - (Yellow Indiangrass) Temporarily Flooded Herbaceous Alliance
Association	*(Betula nigra, Ilex verticillata) / Andropogon gerardii - Solidago simplex* ssp. *randii* var. *racemosa* Shrub Herbaceous Vegetation
Association (English name)	(River Birch, Common Winterberry) / Big Bluestem - Sticky Goldenrod Shrub Herbaceous Vegetation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: This rivershore prairie occurs along the high-energy reaches of the Gauley, Tygart's Valley, Middle Fork, and Cheat rivers in West Virginia, and possibly elsewhere in the region. It occurs in small patches and linear zones subject to very frequent, high-energy flooding. The most well-developed occurrences are located along rapids created by constrictions in the river channel (bedrock outcrops, point bars, bends, islands, alluvial fans). Substrates are

primarily sandstone bedrock and boulders. There is often an elevation range of a few meters within stands which creates wet and dry microsites and provides elevated rooting substrate. Bedrock and boulders also provide structure which protects vegetation from high-energy flows. Unvegetated ground cover in most plots is dominated by bedrock and large rocks, but a few areas have higher cover of small rocks and sand, and some have some standing water. The physiognomy is mixed shrub and herbaceous cover, with herbs dominating the general aspect; in places, it may include a few taller individuals of *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore) (0–30% cover, trees less than 10 m tall). Cover in the tall-shrub layer ranges from 0 to 30%, and cover in the short-shrub layer ranges from 0 to 60%. Common species in the shrub layers include *Betula nigra* (river birch), *Platanus occidentalis* (American sycamore), *Ilex verticillata* (common winterberry), *Cornus amomum* (silky dogwood), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), *Rhododendron arborescens* (smooth azalea), *Hypericum prolificum* (shrubby St. Johnswort), *Alnus serrulata* (hazel alder), *Diospyros virginiana* (common persimmon), *Nyssa sylvatica* (blackgum), *Xanthorhiza simplicissima* (yellowroot), *Rosa palustris* (swamp rose), *Cephalanthus occidentalis* (common buttonbush), and *Salix caroliniana* (coastal plain willow). The federally listed threatened shrub *Spiraea virginiana* (Virginia meadowsweet) occurs in a few locations. Cover in the herb layer of plots ranges from 5 to 60%, and this stratum usually has the highest cover. Common herbs include *Andropogon gerardii* (big bluestem), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Packera paupercula* (balsam groundsel), *Eupatorium fistulosum* (trumpetweed), *Dichanthelium clandestinum* (deertongue), *Symphyotrichum laeve* var. *concinnum* (smooth blue aster), *Sorghastrum nutans* (Indiangrass), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Euphorbia corollata* (flowering spurge), *Clematis virginiana* (devil's darning needles), *Physostegia virginiana* ssp. *virginiana* (obedient plant), *Osmunda regalis* var. *spectabilis* (royal fern), *Viola pedata* (birdfoot violet), *Hypoxis hirsuta* (common goldstar), and *Lysimachia lanceolata* (lanceleaf loosestrife). Additional characteristic herbs include *Ionactis linariifolius* (flaxleaf whitetop aster), *Linum virginianum* (woodland flax), *Zizia aptera* (meadow zizia), *Dichanthelium sphaerocarpon* var. *isophyllum* (roundseed panicgrass), *Marshallia grandiflora* (Monongahela Barbara's buttons), *Liatris scariosa* (devil's bite), and *Baptisia tinctoria* (horseflyweed). Vascular plant species richness in sampled plots ranges from 18 to 70 taxa (mean = 36.4). Nonvascular cover can be high, consisting mostly of bryophytes and lichens on rock.

Environmental Description: This association occurs in small patches and linear zones in positions along rivershores subject to very frequent, high-energy flooding. Flooding disturbance maintains an open physiognomy by removing or damaging trees before they become large enough to provide significant shade. The largest, best developed occurrences are located along rapids created by constrictions in the river channel (bedrock outcrops, point bars, bends, islands, alluvial fans). Slopes in mapped polygons (Gauley River) range from 0 to 34 degrees (mean = 12). Elevations in mapped polygons (Gauley River) range from 207 to 512 m (mean = 315). Substrates are primarily sandstone bedrock and boulders. There is often an elevation range of a few meters within stands which creates wet and dry microsites and provides elevated rooting substrate. Bedrock and boulders also provide structure which protects vegetation from high-energy flows. Unvegetated ground cover is dominated by bedrock and large rocks, but some areas have higher cover of small rocks and sand, and some areas have patches of standing water. Soils are temporarily flooded, moderately well- to rapidly-drained sand and sandy loam. Soils test strongly to very slightly acidic (mean pH = 5.75) with relatively high levels of Mg, Mn, Na,

and Zn, and relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, K, and P.

Vegetation Description: This association has mixed shrub and herbaceous physiognomy and may include a few taller trees. Trees are less than 10 m tall and canopy cover ranges from 0 to 30%. Common trees include *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore). Cover in the tall-shrub layer ranges from 0 to 30%, and cover in the short-shrub layer ranges from 0 to 60%. Common shrubs include *Betula nigra* (river birch), *Platanus occidentalis* (American sycamore), *Ilex verticillata* (common winterberry), *Cornus amomum* (silky dogwood), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), *Rhododendron arborescens* (smooth azalea), *Hypericum prolificum* (shrubby St. Johnswort), *Alnus serrulata* (hazel alder), *Diospyros virginiana* (common persimmon), *Nyssa sylvatica* (blackgum), *Xanthorhiza simplicissima* (yellowroot), *Rosa palustris* (swamp rose), *Cephalanthus occidentalis* (common buttonbush), and *Salix caroliniana* (coastal plain willow). The federally listed threatened shrub *Spiraea virginiana* (Virginia meadowsweet) and the state-rare shrub *Prunus pumila* (sandcherry) both have been occasionally found in this association. Cover in the herb layer ranges from 5 to 60%, and this stratum usually has the highest cover. Common herbs include *Andropogon gerardii* (big bluestem), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Packera paupercula* (balsam groundsel), *Eupatorium fistulosum* (trumpetweed), *Dichanthelium clandestinum* (deertongue), *Symphyotrichum laeve* var. *concinnum* (smooth blue aster), *Sorghastrum nutans* (Indiangrass), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Euphorbia corollata* (flowering spurge), *Clematis virginiana* (devil's darning needles), *Physostegia virginiana* ssp. *virginiana* (obedient plant), *Osmunda regalis* var. *spectabilis* (royal fern), *Viola pedata* (birdfoot violet), *Hypoxis hirsuta* (common goldstar), and *Lysimachia lanceolata* (lanceleaf loosestrife). Additional characteristic herbs include *Ionactis linariifolius* (flaxleaf whitetop aster), *Linum virginianum* (woodland flax), *Zizia aptera* (meadow zizia), *Dichanthelium sphaerocarpon* var. *isophyllum* (roundseed panicgrass), *Marshallia grandiflora* (Monongahela Barbara's buttons), *Liatris scariosa* (devil's bite), and *Baptisia tinctoria* (horseflyweed). Vascular plant species richness in sampled plots ranges from 18 to 70 taxa (mean = 36.4, N=27). Nonvascular cover can be high, consisting mostly of bryophytes and lichens on rock. Bryophytes include *Porella pinnata* (aquatic tongue liverwort), *Hedwigia ciliata* (ciliate hedwigia moss), *Climacium americanum* (American climacium moss), *Sematophyllum demissum* (sematophyllum moss), *Grimmia laevigata* (grimmia dry rock moss), *Campylopus tallulensis* (Tallul campylopus moss), and *Fissidens osmundioides* (osmund fissidens moss). Lichens include *Xanthoparmelia conspersa* (xanthoparmelia lichen) and a distinctive "whitewash" growth on the downstream side of boulders, possibly *Phlyctis petraea* or a related species.

Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	*Betula nigra* (river birch)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem)
		Sorghastrum nutans (Indiangrass)

Characteristic Species: *Alnus serrulata* (hazel alder), *Andropogon gerardii* (big bluestem), *Betula nigra* (river birch), *Cephalanthus occidentalis* (common buttonbush), *Clematis virginiana* (devil's darning needles), *Cornus amomum* (silky dogwood), *Dichanthelium clandestinum* (deertongue), *Diospyros virginiana* (common persimmon), *Eupatorium fistulosum* (trumpetweed), *Euphorbia corollata* (flowering spurge), *Hypericum prolificum* (shrubby St. Johnswort), *Hypoxis hirsuta* (common goldstar), *Ilex verticillata* (common winterberry),

Lysimachia lanceolata (lanceleaf loosestrife), *Nyssa sylvatica* (blackgum), *Osmunda regalis* var. *spectabilis* (royal fern), *Packera paupercula* (balsam groundsel), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), *Physostegia virginiana* ssp. *virginiana* (obedient plant), *Platanus occidentalis* (American sycamore), *Rhododendron arborescens* (smooth azalea), *Rosa palustris* (swamp rose), *Salix caroliniana* (coastal plain willow), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Sorghastrum nutans* (Indiangrass), *Symphyotrichum laeve* var. *concinnum* (smooth blue aster), *Viola pedata* (birdfoot violet), *Xanthorhiza simplicissima* (yellowroot).

Other Noteworthy Species:

Species	GRank	Type	Note
Marshallia grandiflora (Monongahela Barbara's buttons)	G2	plant	WV state-rare plant (S2)
Spiraea virginiana (Virginia meadowsweet)	G2	plant	Federally listed threatened; global imperiled

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association is known from the Gauley, Tygart's Valley, Middle Fork, and Cheat rivers on the west slope of the Eastern Continental Divide in West Virginia. Whether it extends to other similar rivers in the region has not been conclusively determined.

States/Provinces: WV:S2.

Federal Lands: NPS (Gauley River).

CONSERVATION STATUS

Rank: G2 (3-Feb-2010).

Reasons: This association is only known from four rivers in West Virginia. Each river constitutes a single Element Occurrence.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: In an analysis of riverscour communities throughout West Virginia, plots of this association at Gauley River clustered strongly together as a group distinct from riverscour prairie plots that are classified as *Andropogon gerardii - Panicum virgatum - Baptisia australis* Herbaceous Vegetation (CEGL006283) from New River Gorge National River (Vanderhorst et al. 2007) and the Greenbrier River. They clustered together with plots of shrubby prairies from high-energy reaches of the Tygart's Valley, Middle Fork, and Cheat rivers in north-central West Virginia. These river reaches share acidic sandstone bedrock and boulder substrate and extremely high-energy flows. The "prairie-like situation" described by Bush (1976) describes this vegetation at Arden along the Tygart's Valley River. Similar vegetation may also occur along the Youghiogheny in Pennsylvania. A regional review of similar vegetation from the Potomac to western Pennsylvania and south to the Cumberlands would be instructive to clarify the differences and confirm the correct circumscription of associations.

Similar Associations:

- *(Salix caroliniana, Rhododendron arborescens) - Andropogon gerardii - Baptisia australis - (Solidago simplex* ssp. *randii)* Herbaceous Vegetation (CEGL008471)--is described from somewhat south of here and includes both sandstone and limestone variants.
- *Andropogon gerardii - Panicum virgatum - Baptisia australis* Herbaceous Vegetation (CEGL006283)--occurs on cobble/boulder bars with higher base status; the present association lacks *Baptisia australis* and high cover by vines such as *Vitis rupestris* and *Campsis radicans*, and includes a large number of cushion-forming herbs such as *Marshallia grandiflora, Solidago simplex* ssp. *randii* var. *racemosa*, and *Packera paupercula*.

- *Platanus occidentalis - Betula nigra / Cornus amomum / (Andropogon gerardii, Chasmanthium latifolium)* Woodland (CEGL003725)--is woodier overall and differs somewhat floristically.

Related Concepts: Information not available.

SOURCES

Description Authors: S. C. Gawler.

References: Bush 1976, Eastern Ecology Working Group n.d., Vanderhorst et al. 2007, Vanderhorst et al. 2010, Walton and Anderson 1997.

Plot GARI.101. Riverscour Shrub Prairie.

COMMON NAME (PARK-SPECIFIC): BUR-REED MARSH

SYNONYMS

USNVC English Name:	**American Bur-reed - (Simple-stem Bur-reed) - Bog Willowherb Herbaceous Vegetation**
USNVC Scientific Name:	***Sparganium americanum - (Sparganium erectum* ssp. *stoloniferum) - Epilobium leptophyllum* Herbaceous Vegetation**
USNVC Identifier:	**CEGL004510**

LOCAL INFORMATION

Environmental Description: The one stand of this wetland association at GARI occurs in the floodplain of the Gauley River at Iron Ring Rapids. Elevation of the site is about 354 m. The site is in a back channel which is flooded by overbank flows at high flood stages and which receives and accumulates runoff from uplands throughout the year. Hydrology of the wetland appears to vary from year to year. The herbaceous marsh vegetation occurs on level, poorly drained, sandy alluvium behind riverside sandstone bedrock and huge boulders. Soils usually remain saturated and there may be standing water throughout the growing season. Soil in a plot is described as very poorly drained sandy loam with organic muck. Soil from one plot tested strongly acidic (pH = 4.90) with relatively high levels of estimated N release, S, B, Fe, Mg, and Zn, and relatively low levels of total exchange capacity, organic matter, Al, Ca, Cu, K, Mn, Na, and P compared to average values from all plots in the park. Adjacent vegetation on the floodplain includes American Sycamore - River Birch Riverscour Woodland (CEGL003725) and Riverscour Shrub Prairie (CEGL006623).

Vegetation Description: The single known stand of this association at GARI is in a wetland with temporarily and spatially variable composition. The wetland is partially shaded by overhanging *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch), and there is a shrubby zone with *Spiraea alba* var. *alba* (white meadowsweet) and *Cornus amomum* (silky dogwood) which surrounds an open center with standing water, bare mucky litter, and a patch of herbaceous marsh vegetation. A plot was centered on the herbaceous zone which was dominated by a species of *Sparganium* (bur-reed), tentatively identified as *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed). Other prominent herbs in this patch include *Eleocharis acicularis* (needle spikerush), *Leersia oryzoides* (rice cutgrass), *Sagittaria latifolia* (broadleaf arrowhead), *Alisma subcordatum* (American water plantain), *Boehmeria cylindrica* (small-spike false nettle), *Carex crinita* var. *crinita* (fringed sedge), *Galium tinctorium* (stiff marsh bedstraw), *Isoetes engelmannii* (Appalachian quillwort), *Ludwigia palustris* (marsh seedbox), *Lycopus virginicus* (Virginia water horehound), *Lysimachia terrestris* (earth loosestrife), *Penthorum sedoides* (ditch stonecrop), and *Polygonum hydropiperoides* (swamp smartweed). The wetland was revisited in subsequent years after the plot was sampled and dominance by *Sparganium* (bur-reed) was somewhat diminished.

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species:

Species	GRank	Type	Note
Carex bromoides ssp. *bromoides* (bromelike sedge)	-	plant	WV state-rare plant

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	S2	=	1	*Sparganium (americanum, chlorocarpum)* marsh	Byers et al. 2007

Local Range: One occurrence is known in the park along the Gauley River, river left, at Iron Ring Rapids.
Classification Comments: The one stand at GARI is tentatively placed in this association based solely on dominance of *Sparganium* (bur-reed). Specimens of *Sparganium* (bur-reed) collected from this site are immature and are tentatively identified as *Sparganium chlorocarpum* (simplestem bur-reed), which is considered native to West Virginia, although it has been synonymized with *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed), which is often considered exotic and invasive. Taxonomy of *Sparganium* (bur-reed) is difficult and in need of global standardization.
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: One plot was sampled: GARI.82.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)
Alliance	*Sparganium americanum* Seasonally Flooded Herbaceous Alliance (A.1388)
Alliance (English name)	American Bur-reed Seasonally Flooded Herbaceous Alliance
Association	*Sparganium americanum - (Sparganium erectum* ssp. *stoloniferum) - Epilobium leptophyllum* Herbaceous Vegetation
Association (English name)	American Bur-reed - (Simple-stem Bur-reed) - Bog Willowherb Herbaceous Vegetation
Ecological System(s):	Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018).
	South-Central Interior Small Stream and Riparian (CES202.706).
	High Allegheny Wetland (CES202.069).

GLOBAL DESCRIPTION

Concept Summary: This vegetation occupies marshes and impoundments within small rivers or streams with seasonal flooding, especially in areas currently or formerly flooded by beavers or restricted by natural bedrock or boulder accumulation. Most sites were heavily altered by logging in the late 1800s through the early 1900s, and this disturbance may have altered the distribution, cover, and physiognomy of these wetlands. Soils are variable and may consist of poorly to very poorly drained muck or organic-rich loamy soils of varying texture. *Sparganium americanum* (American bur-reed) strongly dominates the dense herb layer at many sites, although at some locations in the Allegheny Mountains and on the Cumberland Plateau, it is replaced by *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed). Common associates vary with geography and include *Agrostis hyemalis* (winter bentgrass), *Callitriche heterophylla* (twoheaded water-starwort), *Carex scoparia* (broom sedge), *Carex gynandra* (nodding sedge), *Carex lurida* (shallow sedge), *Carex stipata* (owlfruit sedge), *Eleocharis obtusa* (blunt

spikerush), *Epilobium coloratum* (purpleleaf willowherb), *Epilobium leptophyllum* (bog willowherb), *Galium tinctorium* (stiff marsh bedstraw), *Glyceria melicaria* (melic mannagrass), *Glyceria striata* (fowl mannagrass), *Hydrocotyle americana* (American marshpennywort), *Hypericum mutilum* (dwarf St. Johnswort), *Impatiens capensis* (jewelweed), *Juncus effusus* (common rush), *Leersia oryzoides* (rice cutgrass), *Ludwigia palustris* (marsh seedbox), *Lycopus uniflorus* (northern bugleweed), *Poa palustris* (fowl bluegrass), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Polygonum punctatum* (dotted smartweed), *Potamogeton* (pondweed) spp., *Scirpus cyperinus* (woolgrass), *Scirpus hattorianus* (mosquito bulrush), *Scutellaria lateriflora* (blue skullcap), *Solidago rugosa* (wrinkleleaf goldenrod), *Sphenopholis pensylvanica* (swamp wedgescale), and *Symphyotrichum prenanthoides* (crookedstem aster). More locally, *Glyceria grandis* (American mannagrass) is an abundant grass. A very sparse shrub layer may be present.

Environmental Description: This vegetation occupies marshes and impoundments within small rivers or streams with seasonal flooding, especially in areas currently or formerly flooded by beavers or restricted by natural bedrock or boulder accumulation. In the Allegheny Mountains area, it occurs within northern hardwood or red spruce forest zones at 600 to 1300 m elevation; in Virginia, it is restricted to gentle, upper-slope streamhead valleys above 1060 m (3500 ft) elevation, where it occurs in patch-mosaics with wet spruce forests, sphagnous seepage bogs, and open to scrubby meadows; it can also occur at lower elevations, for example on the northern Cumberland Plateau where it is found at 350 m elevation. Most sites were heavily altered by logging in the late 1800s through the early 1900s, and this disturbance may have altered the distribution, cover, and physiognomy of these wetlands. Soils are variable and may consist of poorly to very poorly drained muck, or organic-rich loamy soils of varying texture. Average depth of organic soil is 35 cm. Hydric soil indicators include histisol, histic epipedon, hydrogen sulfide, 2 cm muck, sandy gleyed matrix, depleted matrix, redox depressions, and iron/manganese masses. Soil pH averages 4.5 (n=78) and can be as low as 3.9. Soil chemistry is characterized by high B, Fe, S; moderate Al, Ca, Cu, K, Na, Mg, Zn, exchangeable nitrogen, and total exchange capacity; and low Mn, P, and organic matter (n=7).

Vegetation Description: Vegetation of this community type is almost entirely herbaceous, although some stands may have a sparse (<10%) shrub layer. *Sparganium* (bur-reed) spp. strongly dominate the dense herb layer. *Sparganium americanum* (American bur-reed) dominates in Virginia occurrences; in the Allegheny Mountains and Cumberland Plateau, it is sometimes replaced by *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed). *Scirpus expansus* (woodland bulrush) may dominate or codominate with *Sparganium americanum* (American bur-reed) in some areas. Common associates vary with geography and include *Agrostis hyemalis* (winter bentgrass), *Callitriche heterophylla* (twoheaded water-starwort), *Carex scoparia* (broom sedge), *Carex gynandra* (nodding sedge), *Carex lurida* (shallow sedge), *Carex stipata* (owlfruit sedge), *Eleocharis obtusa* (blunt spikerush), *Epilobium coloratum* (purpleleaf willowherb), *Epilobium leptophyllum* (bog willowherb), *Galium tinctorium* (stiff marsh bedstraw), *Glyceria melicaria* (melic mannagrass), *Glyceria striata* (fowl mannagrass), *Hydrocotyle americana* (American marshpennywort), *Hypericum mutilum* (dwarf St. Johnswort), *Impatiens capensis* (jewelweed), *Juncus effusus* (common rush), *Leersia oryzoides* (rice cutgrass), *Ludwigia palustris* (marsh seedbox), *Lycopus uniflorus* (northern bugleweed), *Poa palustris* (fowl bluegrass), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Polygonum punctatum* (dotted smartweed), *Potamogeton* (pondweed) spp., *Scirpus cyperinus* (woolgrass), *Scirpus hattorianus* (mosquito bulrush),

Scutellaria lateriflora (blue skullcap), *Solidago rugosa* (wrinkleleaf goldenrod), *Sphenopholis pensylvanica* (swamp wedgescale), and *Symphyotrichum prenanthoides* (crookedstem aster). More locally, *Glyceria grandis* (American mannagrass) is an abundant grass.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Sparganium americanum* (American bur-reed) *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed)

Characteristic Species: *Carex gynandra* (nodding sedge), *Carex scoparia* (broom sedge), *Carex stipata* (owlfruit sedge), *Eleocharis obtusa* (blunt spikerush), *Epilobium leptophyllum* (bog willowherb), *Glyceria grandis* (American mannagrass), *Hydrocotyle americana* (American marshpennywort), *Juncus effusus* (common rush), *Leersia oryzoides* (rice cutgrass), *Ludwigia palustris* (marsh seedbox), *Scirpus expansus* (woodland bulrush), *Sparganium americanum* (American bur-reed), *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed).

Other Noteworthy Species:

Species	GRank	Type	Note
Aeshna canadensis (Canada darner)	-	animal	
Aeshna tuberculifera (black-tipped darner)	-	animal	
Aeshna verticalis (green-striped darner)	-	animal	
Arigomphus furcifer (lilypad clubtail)	-	animal	
Colias interior (pink-edged sulphur)	-	animal	
Cordulegaster diastatops (delta-spotted spiketail)	-	animal	
Cordulia shurtleffii (American emerald)	-	animal	
Enallagma annexum (northern bluet)	-	animal	
Enallagma hageni (Hagen's bluet)	-	animal	
Epitheca canis (beaverpond baskettail)	-	animal	
Gomphus borealis (beaverpond clubtail)	-	animal	
Juncus brevicaudatus (narrowpanicle rush)	-	plant	VA S2
Ladona julia (chalk-fronted corporal)	-	animal	
Lanthus parvulus (northern pygmy clubtail)	-	animal	
Lestes disjunctus (northern spreadwing)	-	animal	
Leucorrhinia frigida (frosted whiteface)	-	animal	
Leucorrhinia hudsonica (Hudsonian whiteface)	-	animal	
Nehalennia irene (sedge sprite)	-	animal	
Nemotaulius hostilis (a limnephilid caddisfly)	-	animal	
Poa palustris (fowl bluegrass)	-	plant	VA S1S2
Rhionaeschna mutata (spatterdock darner)	-	animal	
Somatochlora elongata (ski-tipped emerald)	-	animal	
Somatochlora williamsoni (Williamson's emerald)	-	animal	
Sympetrum obtrusum (white-faced meadowhawk)	-	animal	

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This community is known from a few high-elevation sites in the Southern Blue Ridge of North Carolina, the Southern Cumberland/ Ridge and Valley of Georgia, and the greater Allegheny Mountains area of Virginia and West Virginia.

States/Provinces: GA, NC, TN, VA:SU, WV:S2.

Federal Lands: NPS (Chickamauga-Chattanooga, Gauley River, New River Gorge); USFS (George Washington, Monongahela, Pisgah); USFWS (Canaan Valley).

CONSERVATION STATUS

Rank: G3? (9-Apr-2010).

Reasons: This association is known from only a small number of sites, each very small. Most sites are dependent on periodic re-establishment by beaver flooding. The rank is questionable because the total range and abundance of this association is not clearly known.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Similar vegetation may occur in the Ridge and Valley of Virginia in abandoned beaver ponds. [See VDNH's Laurel Fork report, *Carex stipata - Sparganium americanum* subassociation (Fleming and Moorhead 1996).].

Similar Associations: Information not available.

Related Concepts:

- *Picea rubens / Vaccinium angustifolium - Epilobium leptophyllum* Association: *Carex stipata - Sparganium americanum* Subassociation (Fleming and Moorhead 1996) ?
- *Sparganium americanum - Epilobium leptophyllum* Herbaceous Vegetation (Fleming and Coulling 2001) ?
- *Sparganium americanum - Scirpus* spp. herbaceous wetland (Vanderhorst 2001b) =
- *Sparganium americanum* herbaceous vegetation (Hall 2005a) =
- Appalachian Bog (Fleming et al. 2001) B
- IID6a. Natural Impoundment Pond (Allard 1990) B
- Piedmont/Mountain Semipermanent Impoundment (Montane Boggy Subtype) (Schafale 1998b) ?

SOURCES

Description Authors: G. Fleming and P. Coulling, mod. S. C. Gawler and E. A. Byers.

References: Allard 1990, Allard and Leonard 1952, Byers et al. 2007, FNA Editorial Committee 2000, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Fleming et al. 2004, Hall 2005a, Peet et al. unpubl. data 2002, Putnam 1995, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Strausbaugh and Core 1978, Suiter 1995, Suiter and Evans 1999, TDNH unpubl. data, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2010.


Plot GARI.82. Bur-reed Marsh.

COMMON NAME (PARK-SPECIFIC): AMERICAN WATER-WILLOW COBBLE BAR

SYNONYMS
USNVC English Name: **American Water-willow Herbaceous Vegetation**
USNVC Scientific Name: ***Justicia americana* Herbaceous Vegetation**
USNVC Identifier: **CEGL004286**

LOCAL INFORMATION

Environmental Description: This association occurs on wet cobble and boulder bars within the active river channel. Stands are subject to frequent high-energy floods but appear to be absent from the high-gradient "whitewater" reaches of the Gauley River. Stands are submerged for long periods throughout the year and the substrate rarely dries out. Elevations in mapped polygons range from 207 to 208 m. Rooting substrate is sand in the interstices between cobbles and boulders. Soils test slightly to medium acidic (mean pH = 5.80) with relatively high levels of Fe, Mn, and Zn, and relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, B, Ca, K, and P compared to average values from all plots in the park. Adjacent vegetation at one site is Riverscour Shrub Prairie (CEGL006623).
Vegetation Description: This association represents herbaceous vegetation strongly dominated by the hydrophyte *Justicia americana* (American water-willow). Woody species that sometimes overhang the edges of this community or are present with low cover in the shrub layers include *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), *Cephalanthus occidentalis* (common buttonbush), and *Salix caroliniana* (coastal plain willow). Cover by *Justicia americana* (American water-willow) ranges from 5 to 40% in plots. Associated herbs which have low cover in plots include the natives *Physostegia virginiana* ssp. *virginiana* (obedient plant), *Boehmeria cylindrica*, *Osmunda regalis* (royal fern) var. *spectabilis*, and *Viola cucullata* (marsh blue violet), and the exotics *Polygonum cuspidatum* (Japanese knotweed) and *Xanthium strumarium* (rough cockleburr).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	.	.	[not crosswalked]	.

Local Range: Three small polygons are mapped in the park along the lower Gauley River near Swiss and an additional small patch was sampled by a plot about 2 km upstream. Additional small patches are very likely included in the River and Riparian Zone map classes.
Classification Comments: In a previous study of riparian communities at GARI, Walton and Anderson (1997) described a *Justicia americana - Andropogon gerardii* herbaceous channel bed based on a single plot (GARI.26). Plot data collected for their study were incorporated in this analysis and GARI.26 was attributed to the Riverscour Shrub Prairie (CEGL006623).
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Two plots were sampled: GARI.84 and GARI.211.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial forb vegetation (V.B.)
Physiognomic Group	Temperate or subpolar perennial forb vegetation (V.B.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
Formation	Temporarily flooded temperate perennial forb vegetation (V.B.2.N.d.)
Alliance	*Justicia americana* Temporarily Flooded Herbaceous Alliance (A.1657)
Alliance (English name)	American Water-willow Temporarily Flooded Herbaceous Alliance
Association	*Justicia americana* Herbaceous Vegetation
Association (English name)	American Water-willow Herbaceous Vegetation
Ecological System(s):	Central Appalachian River Floodplain (CES202.608). Central Appalachian Stream and Riparian (CES202.609). South-Central Interior Small Stream and Riparian (CES202.706). Southern Piedmont Small Floodplain and Riparian Forest (CES202.323). Cumberland Riverscour (CES202.036). South-Central Interior Large Floodplain (CES202.705). Ozark-Ouachita Riparian (CES202.703).

GLOBAL DESCRIPTION

Concept Summary: This association is found primarily in the Piedmont, Central Appalachians, Cumberland Plateau, Interior Low Plateau, Ozarks, Ouachita Mountains, and adjacent provinces. Stands occur on the shoals or bars of rocky streams and riverbeds, where they are subject to frequent high-energy floods. Slopes range from level to moderate but are typically gentle. The substrate is a variable mixture of sand, gravel and cobbles, often with deposits of silt and muck. Rooting occurs in the interstices between cobbles and boulders. *Justicia americana* (American water-willow) is the characteristic dominant. *Saururus cernuus* (lizard's-tail) is often present and may be codominant. Other herbaceous species that may be present include *Bidens* (beggarticks) spp., *Cyperus* (flatsedge) spp., *Diodia teres* (poorjoe), *Elodea* (waterweed) sp., *Eleocharis* (spikerush) spp., *Equisetum arvense* (field horsetail), *Gratiola brevifolia* (sticky hedgehyssop), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Lemna minor* (common duckweed), *Orontium aquaticum* (goldenclub), *Physostegia virginiana* (obedient plant), *Podostemum ceratophyllum* (hornleaf riverweed), *Polygonum caespitosum* var. *longisetum* (oriental ladysthumb), *Scirpus* (bulrush) spp., *Schoenoplectus pungens* (common threesquare), *Schoenoplectus tabernaemontani* (softstem bulrush), and *Xyris difformis* var. *difformis* (bog yelloweyed grass). Exotics include *Lythrum salicaria* (purple loosestrife) and *Lysimachia vulgaris* (garden yellow loosestrife); where present, these are sparse. Some stands have low cover by scattered flood-suppressed trees or an overhanging canopy. Trees in plots include *Acer saccharinum* (silver maple), *Betula nigra* (river birch), *Carpinus caroliniana* (American hornbeam), *Fraxinus pennsylvanica* (green ash), and *Platanus occidentalis* (American sycamore). Scattered shrub seedlings of *Salix nigra* (black willow), *Salix caroliniana* (coastal plain willow), *Betula nigra* (river birch), *Cephalanthus occidentalis* (common buttonbush), *Acer saccharinum* (silver maple), or *Platanus occidentalis* (American sycamore) may also be present. This association provides habitat in some portions of its range for globally rare dragonflies and herbs.

Environmental Description: This association occurs on the shoals or bars of rocky streams and riverbeds, on bedrock, boulders, cobble, gravel, and sands. They are subject to frequent high-energy floods, and are entirely submerged by most flood events. During extreme low water periods, the substrate can be exposed, showing a varied mixture of sand, gravel and cobbles,

often with deposits of silt and muck. Rooting occurs in the interstices between cobbles and boulders. Stands commonly occur on the edge of the river and at the heads and tails of islands and may sometimes occur on deposition bars in the middle of the river. Substrate pH is circumneutral (mean = 6.0) in four samples. Slopes range from level to moderate but are typically gentle. Elevations of West Virginia stands range from 73 to at least 654 m; the type occurs at lower elevations in the Piedmont and Coastal Plain.

Vegetation Description: *Justicia americana* (American water-willow) is the dominant (and sometimes the only) species, forming lawnlike stands in shallow reaches of rivers. Cover by *Justicia americana* (American water-willow) ranges from 40 to 85%. *Saururus cernuus* (lizard's-tail) is often present and may be codominant. Other herbaceous species may be present but rarely achieve more than 2% cover; they include *Bidens* (beggarticks) spp., *Cyperus* (flatsedge) spp., *Diodia teres* (poorjoe), *Elodea* (waterweed) sp., *Eleocharis* (spikerush) spp., *Equisetum arvense* (field horsetail), *Gratiola brevifolia* (sticky hedgehyssop), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Lemna minor* (common duckweed), *Orontium aquaticum* (goldenclub), *Physostegia virginiana* (obedient plant), *Podostemum ceratophyllum* (hornleaf riverweed), *Polygonum caespitosum* var. *longisetum* (oriental ladysthumb), *Scirpus* (bulrush) spp., *Schoenoplectus pungens* (common threesquare), *Schoenoplectus tabernaemontani* (softstem bulrush), and *Xyris difformis* var. *difformis* (bog yelloweyed grass). Exotics include *Lythrum salicaria* (purple loosestrife) and *Lysimachia vulgaris* (garden yellow loosestrife); they have not been observed in abundance in this community, possibly due to intolerance of high-energy flooding. In some areas, *Justicia* (water-willow) usually grows in nearly pure patches, so that few other species are associated with it. *Cuscuta gronovii* (scaldweed), *Mimulus ringens* (Allegheny monkeyflower), *Polygonum* (knotweed) spp., *Rumex* (dock) spp., and *Salix interior* (sandbar willow) can also occur (Anderson 1982). Some stands have low cover by scattered flood-suppressed trees or an overhanging canopy. Trees in plots include *Acer saccharinum* (silver maple), *Betula nigra* (river birch), *Carpinus caroliniana* (American hornbeam), *Fraxinus pennsylvanica* (green ash), and *Platanus occidentalis* (American sycamore). Scattered shrub seedlings of *Salix nigra* (black willow), *Salix caroliniana* (coastal plain willow), *Betula nigra* (river birch), *Cephalanthus occidentalis* (common buttonbush), *Acer saccharinum* (silver maple), or *Platanus occidentalis* (American sycamore) may also be present. In the Cumberland Plateau of Alabama, *Justicia americana* (American water-willow) is present in dense patches with some interspersion of other species, including *Pilea pumila* (Canadian clearweed), *Boehmeria cylindrica* (small-spike false nettle), *Eclipta prostrata* (false daisy), *Juncus coriaceus* (leathery rush), *Mikania scandens* (climbing hempvine), *Ludwigia palustris* (marsh seedbox), *Leersia* (cutgrass) sp., and *Bidens* (beggarticks) sp. Schmalzer and DeSelm (1982) discuss *Orontium aquaticum* (goldenclub) growing along streambanks or in shallow riffles "along or with" *Justicia americana* (American water-willow) in the Obed River in the Cumberland Plateau of Tennessee. In 29 plots sampled in the Potomac River watershed (Piedmont, Blue Ridge and Ridge and Valley provinces), *Justicia* (water-willow) was overwhelmingly dominant (50–75% mean cover), and no associated species occurred in more than 48% of the plots. Vascular plant species richness in sampled plots is low (typically 6–14 taxa).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Justicia americana* (American water-willow)

Characteristic Species: *Justicia americana* (American water-willow), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Orontium aquaticum* (goldenclub), *Polygonum*

amphibium (water knotweed), *Polygonum caespitosum* var. *longisetum* (oriental ladysthumb), *Saururus cernuus* (lizard's-tail), *Schoenoplectus pungens* (common threesquare).

Other Noteworthy Species:

Species	GRank	Type	Note
Lysimachia vulgaris (garden yellow loosestrife)	-	plant	exotic
Lythrum salicaria (purple loosestrife)	-	plant	invasive exotic
Marshallia trinervia (broadleaf Barbara's buttons)	G3	plant	
Ptilimnium nodosum (piedmont mock bishopweed)	G2	plant	Federally listed endangered; globally imperiled
Sagittaria secundifolia (Little River arrowhead)	G1	plant	Federally listed threatened; globally critically imperiled

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This type is found primarily in the Piedmont, Interior Low Plateau, Cumberland Plateau, Ozarks, Ouachita Mountains, Central Appalachians, and adjacent provinces. It ranges from Alabama, Georgia and the Carolinas west to Arkansas and Oklahoma and north to Ohio, New York, and New Jersey, with possible outliers north to southern Quebec.

States/Provinces: AL, AR, GA, KY, MD, NC, NJ, NY, OH:S4, OK, PA, QC:S1?, SC?, TN, VA:S4, WV.

Federal Lands: NPS (Appalachian Trail, Big South Fork, Buffalo River, C&O Canal, Delaware Water Gap, Gauley River, George Washington Parkway, Harpers Ferry, Little River Canyon, Mammoth Cave, Manassas, Natchez Trace, New River Gorge, Obed, Stones River, Upper Delaware); USFS (Bankhead, Cherokee, Daniel Boone, Oconee?, Ouachita, Ouachita (Mountains), Ozark, Pisgah, Sumter (Mountains)?, Sumter (Piedmont)?, Sumter?, Uwharrie, Wayne).

CONSERVATION STATUS

Rank: G4G5 (12-Sep-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This type, in Ohio, often forms pure patches, but consistent identification may require a simple cutoff rule, such as at least 50% cover of *Justicia* (water-willow) (Anderson 1982). However, Anderson (1996) no longer recognizes this type.

Similar Associations:

- *Hymenocallis coronaria - Justicia americana* Herbaceous Vegetation (CEGL004285).
- *Justicia americana - Peltandra virginica* Herbaceous Vegetation [Provisional] (CEGL006579)--occurs in freshwater tidal habitats.
- *Peltandra virginica - Saururus cernuus - Boehmeria cylindrica / Climacium americanum* Herbaceous Vegetation (CEGL007696).

Related Concepts:

- *Justicia americana - Andropogon gerardii* herbaceous channel bed (Walton and Anderson 1997) =
- *Justicia americana* riparian herbaceous vegetation (Vanderhorst 2001b) =
- Aquatic Types (Schmalzer and DeSelm 1982) B
- IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990) B
- Lizard's tail emergent bed (Perles et al. 2004) ?
- Rocky Bar / Shore (Fleming and Coulling 2001) B
- Rocky Bar and Shore (Water Willow Subtype) (Schafale 1998b) ?
- Water willow emergent bed (Perles et al. 2004) ?

SOURCES

Description Authors: A. S. Weakley, mod. D. Faber-Langendoen and S. C. Gawler.

References: Allard 1990, Anderson 1982, Anderson 1996, Fike 1999, Fleming 2007, Fleming and Coulling 2001, Fleming et al. 2001, Harrison 2004, Hoagland 1997, Hoagland 2000, Lea 2000, Lea 2004, Major et al. 1999, McCoy 1958, Nelson 1986, ONHD unpubl. data, Palmer-Ball et al. 1988, Peet et al. unpubl. data 2002, Penfound 1953, Perles et al. 2004, Schafale 1998b, Schafale 2002, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC and WPC 2004, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2010, Walton and Anderson 1997.

Plot GARI.84. American Water-willow Cobble Bar.

COMMON NAME (PARK-SPECIFIC): COMMON ROCK TRIPE CLIFF FACE

SYNONYMS
USNVC English Name: **Common Rocktripe Nonvascular Vegetation**
USNVC Scientific Name: ***Umbilicaria mammulata* Nonvascular Vegetation**
USNVC Identifier: **CEGL004387**

LOCAL INFORMATION

Environmental Description: This association occurs on sandstone cliff faces which are less than vertical and are thus exposed to light, rain, and seepage. Cliffs in the park are formed from the Nuttall, Guyandotte, and Raleigh sandstones of the New River formation in the Pottsville group. Slope measured in the one sampled plot is 80 degrees. Elevations in mapped polygons of Cliff Face, which includes patches of this association, range from 250 to 563 m (mean = 407). Soil gathered from crevices in the cliff face from one plot tested extremely acidic (pH = 4.00) with relatively high levels of total exchange capacity, organic matter, estimated N release, S, Al, B, Fe, and K, and relatively low levels of Ca, Cu, Mg, Mn, P, and Zn compared to average values from all plots in the park. Adjacent areas of cliff which have vertical or overhanging faces are classified as Dry Cliff Face (CEGL006435). Cliffs often form a boundary between contrasting forest associations. Typically, the matrix Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543) or Oak / Great Laurel Forest (CEGL006286) occur on colluvial slopes below cliffs, while small patches of Cliff Top Virginia Pine Forest (CEGL007119) and Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest (CEGL008524) occur above cliffs. Many cliffs in the park are used for recreational rock climbing.
Vegetation Description: This association represents sandstone cliff faces dominated by the macrolichen *Umbilicaria mammulata* (navel lichen). There is about 20% cover by this species in the one sampled plot. Woody vascular plants which grow in crevices in trace amounts in the plot include *Acer rubrum* (red maple), *Tsuga canadensis* (eastern hemlock), *Rhododendron maximum* (great laurel), and *Rhododendron catawbiense* (Catawba rosebay). Associated lichens include the crustose species *Lepraria neglecta* (dust lichen). Associated mosses include *Andreaea rothii* (Roth's Andreaea moss), *Leucobryum albidum* (leucobryum moss), and *Rhabdoweisia crispata* (Rhabdoweisia moss).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	.	.	[not crosswalked]	.

Local Range: Small patches and linear bands of cliffs are scattered throughout the length of the Gauley and Meadow river gorges in the park. They are mostly associated with outcrops of sandstone of the New River formation which are exposed on gorge slopes in the eastern two-thirds of the park.
Classification Comments: Cliffs faces which are vertical or overhanging and are thus protected from light, rain, and seepage are not usually dominated by *Umbilicaria mammulata* (navel lichen) and are classified as Dry Cliff Face (CEGL006435).
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.

Plots: One plot was sampled: GARI.177.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Nonvascular Vegetation (VI)
Physiognomic Subclass	Lichen vegetation (VI.B.)
Physiognomic Group	Temperate or subpolar lichen vegetation (VI.B.1.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar lichen vegetation (VI.B.1.N.)
Formation	Alpine to submontane temperate or subpolar lichen vegetation (VI.B.1.N.b.)
Alliance	*Umbilicaria mammulata* Nonvascular Alliance (A.1827)
Alliance (English name)	Common Rocktripe Nonvascular Alliance
Association	*Umbilicaria mammulata* Nonvascular Vegetation
Association (English name)	Common Rocktripe Nonvascular Vegetation
Ecological System(s):	North-Central Appalachian Acidic Cliff and Talus (CES202.601). Southern Appalachian Montane Cliff and Talus (CES202.330).

GLOBAL DESCRIPTION

Concept Summary: Vegetation is strongly dominated by *Umbilicaria mammulata* (navel lichen), on relatively moist, shaded rock outcrops, often on slopes with northerly aspects. This vegetation occurs where periodic seepage occurs on acidic rock outcrops. Individual occurrences can be as large as an acre. Vascular plants are generally sparse or absent, though trees or shrubs of adjacent forest communities often shade the outcrop community for much of the day. Other umbilicate lichens, shade-tolerant foliose lichens such as *Flavoparmelia baltimorensis*, and numerous crustose lichens may also occur. Associates include scattered individuals of *Dryopteris intermedia* (intermediate woodfern) and *Polypodium appalachianum* (Appalachian polypody).
Environmental Description: This lichen-dominated community occurs on relatively moist, shaded, acidic rock outcrops (bedrock cliffs and vertical surfaces of large exfoliated boulders) where periodic seepage occurs. It is often found on slopes with northerly aspects. Individual occurrences can be as large as an acre.
Vegetation Description: The vegetation is strongly dominated by *Umbilicaria mammulata* (navel lichen). Vascular plants are generally sparse or absent, though trees and shrubs of adjacent forest communities often shade the outcrop community for much of the day. Other umbilicate lichens, shade-tolerant foliose lichens such as *Flavoparmelia baltimorensis*, and numerous crustose lichens (e.g., *Lepraria neglecta*) may also occur. Associates include scattered individuals of *Dryopteris intermedia* (intermediate woodfern) and *Polypodium appalachianum* (Appalachian polypody). Associated mosses include *Andreaea rothii*, *Leucobryum albidum* (leucobryum moss), and *Rhabdoweisia crispata*.
Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Fern or fern ally	*Dryopteris intermedia* (intermediate woodfern)
		Polypodium virginianum (rock polypody)
Nonvascular	Lichen	*Umbilicaria mammulata* (navel lichen)

Characteristic Species: *Umbilicaria mammulata* (navel lichen).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Information not available.
States/Provinces: CT, GA, KY, NC, PA, SC, TN, VA:S3?, WV.
Federal Lands: NPS (Blue Ridge Parkway?, Cumberland Gap, Gauley River, New River Gorge, Shenandoah, Weir Farm); USFS (Cherokee?, George Washington, Jefferson, Monongahela?, Nantahala, Pisgah).

CONSERVATION STATUS

Rank: G4? (15-Aug-1994).
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: Potentially very widespread in Southeast and beyond.
Similar Associations:

- Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation (CEGL006435)--on drier cliff faces.
- *Lasallia papulosa - Umbilicaria caroliniana* Nonvascular Vegetation (CEGL004386).

Related Concepts:

- IE2a. Southern Appalachian Acidic Cliff (Allard 1990) ?
- Lichen / Bryophyte Boulderfield (Fleming and Coulling 2001) B
- Lichen-dominated shaded outcrops (CAP pers. comm. 1998) ?
- Montane Cliff (Carolina Rocktripe Subtype) (Schafale 1998b) ?
- SNE acidic cliff community (Rawinski 1984) ?

SOURCES

Description Authors: A. S. Weakley, mod. G. P. Fleming.
References: Allard 1990, CAP pers. comm. 1998, Fike 1999, Fleming and Coulling 2001, Rawinski 1984, Schafale 1998b, Schafale 2002, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Swain and Kearsley 2001, TDNH unpubl. data, Vanderhorst et al. 2007, Vanderhorst et al. 2010.

Plot GARI.177. Common Rock Tripe Cliff Face.

COMMON NAME (PARK-SPECIFIC): DRY CLIFF FACE

SYNONYMS

USNVC English Name:	**Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation**
USNVC Scientific Name:	**Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation**
USNVC Identifier:	**CEGL006435**

LOCAL INFORMATION

Environmental Description: This association occurs on sandstone cliff faces that are vertical or overhanging and are thus protected from light, rain, and seepage. Cliffs in the park are formed from the Nuttall, Guyandotte, and Raleigh sandstones of the New River formation in the Pottsville group. Elevations in mapped polygons of Cliff Face, which includes patches of this association, range from 250 to 563 m (mean = 407). Soil collected from the cliff base of one plot tested very strongly acidic (pH = 4.4) with relatively high levels of estimated N release, S, Al, B, and Fe, and relatively low levels of total exchange capacity, organic matter, Ca, Cu, K, Mg, Mn, Na, P and Zn compared to average values from all plots in the park. Adjacent areas of cliff which have less than vertical faces are classified as Common Rock Tripe Cliff Face (CEGL004387). Cliffs often form a boundary between contrasting forest associations. Typically, the matrix Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543) or Oak / Great Laurel Forest (CEGL006286) occur on colluvial slopes below cliffs, while small patches of Cliff Top Virginia Pine Forest (CEGL007119) and Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest (CEGL008524) occur above cliffs. Massive cliffs in the gorges of the Gauley and Meadow rivers can have dramatic overhangs which create unique dry habitats utilized by Allegheny wood rats (*Neotoma magister*), antlions (larvae of insects in the family Myrmeleontidae), and humans. Many cliffs in the park are used for recreational rock climbing.
Vegetation Description: This association represents sparsely vegetated sandstone cliff faces. Woody vascular plant species that grow in cracks and crevices in trace amounts in plots include *Rhododendron maximum* (great laurel), *Betula lenta* (sweet birch), and *Acer rubrum* (red maple). Herbs in plots include *Eurybia divaricata* (white wood aster) and *Polypodium virginianum* (rock polypody). Diversity and cover are dominated by lichens and bryophytes. Lichens identified in plots include *Chrysothrix insulizans* (lichen), *Cladina rangiferina* (greygreen reindeer lichen), *Cladonia squamosa* (cup lichen), *Lasallia papulosa* (blistered naval lichen), *Lepraria obscura* (dust lichen), *Lepraria lobificans* (dust lichen), *Lepraria caesiella* (dust lichen), *Lepraria neglecta* (dust lichen), *Phlyctis petraea* (lichen), *Porpidia albocaerulescens* (porpidia lichen), *Usnea amblyoclada* (rock beard lichen), and *Umbilicaria mammulata* (navel lichen) (in trace amounts). Bryophytes identified in plots include *Andreaea rothii* (Roth's andreaea moss), *Bazzania trilobata* (common bazzania liverwort), *Bryoandersonia illecebra* (bryoandersonia moss), *Dicranum scoparium* (dicranum moss), *Diplophyllum apiculatum* (pointed mitten liverwort), *Leucobryum albidum* (leucobryum moss), *Leucobryum glaucum* (leucobryum moss), and *Leucolejeunea clypeata* (white caveleaf liverwort).
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	.	.	[not crosswalked]	.

Local Range: Small patches and linear bands of cliffs are scattered throughout the length of the Gauley and Meadow river gorges in the park. They are mostly associated with outcrops of sandstone of the New River formation which are exposed on gorge slopes in the eastern two-thirds of the park.
Classification Comments: Cliff faces which are less than vertical and are thus exposed to light, rain, and seepage are usually dominated by the macrolichen *Umbilicaria mammulata* (navel lichen) and are classified as Common Rock Tripe Cliff Face (CEGL004387).
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Six plots were sampled: GARI.164, GARI.165, GARI.166, GARI.167, GARI.176, and GARI.180.
Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Sparse Vegetation (VII)
Physiognomic Subclass	Consolidated rock sparse vegetation (VII.A.)
Physiognomic Group	Sparsely vegetated cliffs (VII.A.1.)
Physiognomic Subgroup	Natural/Semi-natural sparsely vegetated cliffs (VII.A.1.N.)
Formation	Cliffs with sparse vascular vegetation (VII.A.1.N.a.)
Alliance	Open Cliff Sparsely Vegetated Alliance (A.1836)
Alliance (English name)	Open Cliff Sparsely Vegetated Alliance
Association	Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation
Association (English name)	Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation
Ecological System(s):	North-Central Appalachian Acidic Cliff and Talus (CES202.601).

GLOBAL DESCRIPTION

Concept Summary: This dry sandstone cliff community occurs in the Western Allegheny Plateau and central Appalachian Mountains of the United States. Stands occur as steep to vertical rock exposures of sandstone bedrock. Aspect is variable, but stands are best developed on south- and west-facing slopes. Vascular plants are restricted to shelves, cracks and crevices in the rock, generally averaging less than 20% cover. Mosses and lichens are common, including crustose lichens. The sparse woody species include *Tsuga canadensis* (eastern hemlock), *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Rhododendron maximum* (great laurel), *Rhododendron periclymenoides* (pink azalea), *Kalmia latifolia* (mountain laurel), *Toxicodendron radicans* (eastern poison ivy), and rarely *Hydrangea arborescens* (wild hydrangea). Herbs are sparse but may include the forbs *Agrostis perennans* (upland bentgrass), *Aquilegia canadensis* (red columbine), *Eurybia divaricata* (white wood aster), *Mitchella repens* (partridgeberry), *Sedum ternatum* (woodland stonecrop), and *Viola blanda* (sweet white violet). *Silene rotundifolia* (roundleaf catchfly) often occurs at the drip line. Ferns such as *Asplenium montanum* (mountain spleenwort), *Asplenium pinnatifidum* (lobed spleenwort), *Asplenium rhizophyllum* (walking fern), *Asplenium trichomanes* (maidenhair spleenwort), *Cystopteris tenuis* (upland brittle bladderfern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Polypodium virginianum* (rock polypody), *Polypodium appalachianum* (Appalachian polypody), *Woodsia*

obtusa (bluntlobe cliff fern), and the rare *Asplenium bradleyi* (Bradley's spleewort) also occur. Massive cliffs in the gorges of the Gauley and Meadow rivers (West Virginia) can have dramatic overhangs which create unique dry habitats utilized by Allegheny wood rats (*Neotoma magister*) and antlions (larvae of insects in the family Myrmeleontidae).

Environmental Description: This community occurs on sandstone cliff faces that are vertical or overhanging and are thus protected from light, rain and seepage, across the Western Allegheny Plateau and central Appalachian Mountains of the United States. Stands occur as steep to vertical rock exposures of sandstone bedrock. Aspect is variable, but stands are best developed on south- and west-facing slopes.

Vegetation Description: Vascular plants are restricted to shelves, cracks and crevices in the rock, generally averaging less than 20% cover. Mosses and lichens are common, including crustose lichens. The sparse woody species include *Tsuga canadensis* (eastern hemlock), *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Rhododendron maximum* (great laurel), *Rhododendron periclymenoides* (pink azalea), *Kalmia latifolia* (mountain laurel), *Toxicodendron radicans* (eastern poison ivy), and rarely *Hydrangea arborescens* (wild hydrangea). The herbaceous layer contains the forbs *Agrostis perennans* (upland bentgrass), *Aquilegia canadensis* (red columbine), *Eurybia divaricata* (white wood aster), *Mitchella repens* (partridgeberry), *Sedum ternatum* (woodland stonecrop), and *Viola blanda* (sweet white violet). *Silene rotundifolia* (roundleaf catchfly) often occurs at the drip line. Ferns such as *Asplenium montanum* (mountain spleenwort), *Asplenium pinnatifidum* (lobed spleenwort), *Asplenium rhizophyllum* (walking fern), *Asplenium trichomanes* (maidenhair spleenwort), *Cystopteris tenuis* (upland brittle bladderfern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Polypodium virginianum* (rock polypody), *Polypodium appalachianum* (Appalachian polypody), *Woodsia obtusa* (bluntlobe cliff fern), and the rare *Asplenium bradleyi* (Bradley's spleewort) also occur. Lichens identified in WV plots include *Chrysothrix insulizans* (lichen), *Cladina rangiferina* (greygreen reindeer lichen), *Cladonia squamosa* (cup lichen), *Lasallia papulosa* (blistered naval lichen), *Lepraria obscura* (dust lichen), *Lepraria lobificans* (dust lichen), *Lepraria caesiella* (dust lichen), *Lepraria neglecta* (dust lichen), *Phlyctis petraea* (lichen), *Porpidia albocaerulescens* (porpidia lichen), *Usnea amblyoclada* (rock beard lichen), and *Umbilicaria mammulata* (navel lichen) (in trace amounts); bryophytes in those plots include *Andreaea rothii* (Roth's andreaea moss), *Bazzania trilobata (common bazzania liverwort)*, *Bryoandersonia illecebra* (bryoandersonia moss), *Dicranum scoparium* (dicranum moss), *Diplophyllum apiculatum* (pointed mitten liverwort), *Leucobryum albidum* (leucobryum moss), *Leucobryum glaucum* (leucobryum moss), and *Leucolejeunea clypeata* (white caveleaf liverwort).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Semi-shrub	*Mitchella repens* (partridgeberry)
Herb (field)	Forb	*Aquilegia canadensis* (red columbine)
Herb (field)	Graminoid	*Agrostis perennans* (upland bentgrass)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Cystopteris tenuis* (upland brittle bladderfern).

Other Noteworthy Species:

Species	GRank	Type	Note
Neotoma magister (Allegheny woodrat)	G3G4	animal	utilize unique dry habitats of cliff overhangs

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association is currently documented from the Western Allegheny Plateau and central Appalachian Mountains of the United States, extending to northern Cumberland Plateau and the New and Gauley rivers in West Virginia.

States/Provinces: OH, PA, VA, WV.

Federal Lands: NPS (Allegheny Portage Railroad, Gauley River, New River Gorge).

CONSERVATION STATUS

Rank: GNR (24-Jan-2003).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: These cliffs are known in some areas as "rockhouses." In Ohio, Anderson (1996) provides several references to lichen composition on sandstone cliffs. Further work is needed to determine whether this association should be classified as lichen-dominated or sparse vegetation, or should be split to recognize dominance of some occurrences by crustose lichens.

Similar Associations:

- *Asplenium montanum - Heuchera parviflora* var. *parviflora - Silene rotundifolia* Sparse Vegetation (CEGL004392).
- *Juniperus virginiana - Corydalis sempervirens* Cliff Sparse Vegetation (CEGL006422).
- Sandstone Dry Cliff Sparse Vegetation (CEGL002045).
- Sandstone Midwest Moist Cliff Sparse Vegetation (CEGL002287).
- *Umbilicaria mammulata* Nonvascular Vegetation (CEGL004387)--occurs on acidic cliffs with more moisture.

Related Concepts:

- Cliff Communities (Anderson 1996) B

SOURCES

Description Authors: L. A. Sneddon, mod. S. C. Gawler.

References: Anderson 1996, Eastern Ecology Working Group n.d., Perles et al. 2007, Sneddon and Menard 2002, Vanderhorst et al. 2007, Vanderhorst et al. 2010.


Plot GARI.176. Dry Cliff Face.

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Coulling, P. P., and T. J. Rawinski. 1999. Classification of vegetation and ecological land units of the Piney River and Mt. Pleasant area, Pedlar Ranger District, George Washington and Jefferson National Forests, Virginia. Natural Heritage Technical Report 99-03, Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond.

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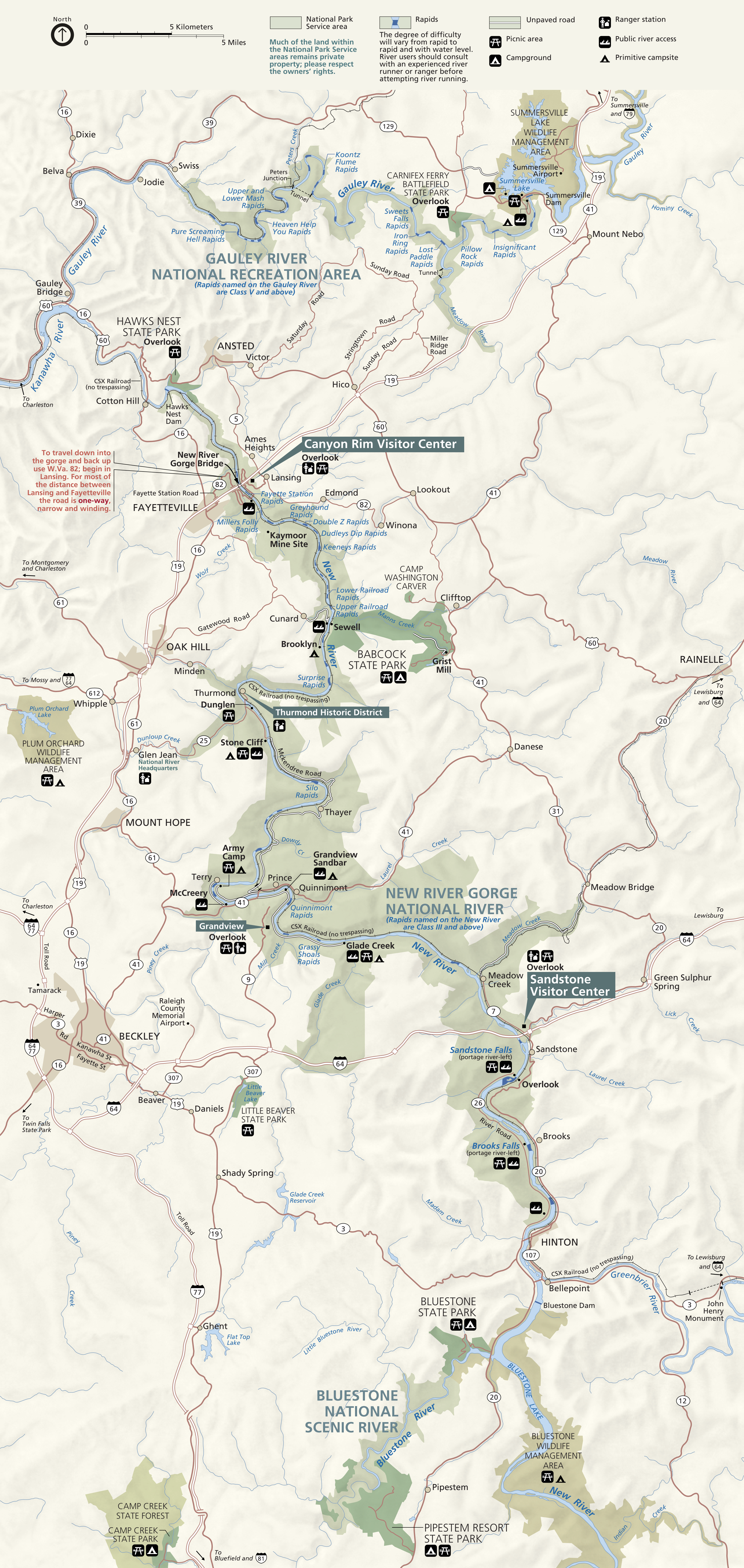
As the nation's primary conservation agency, the Department of the Interior has responsibility for most of our nationally owned public land and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS 600/106020, November 2010

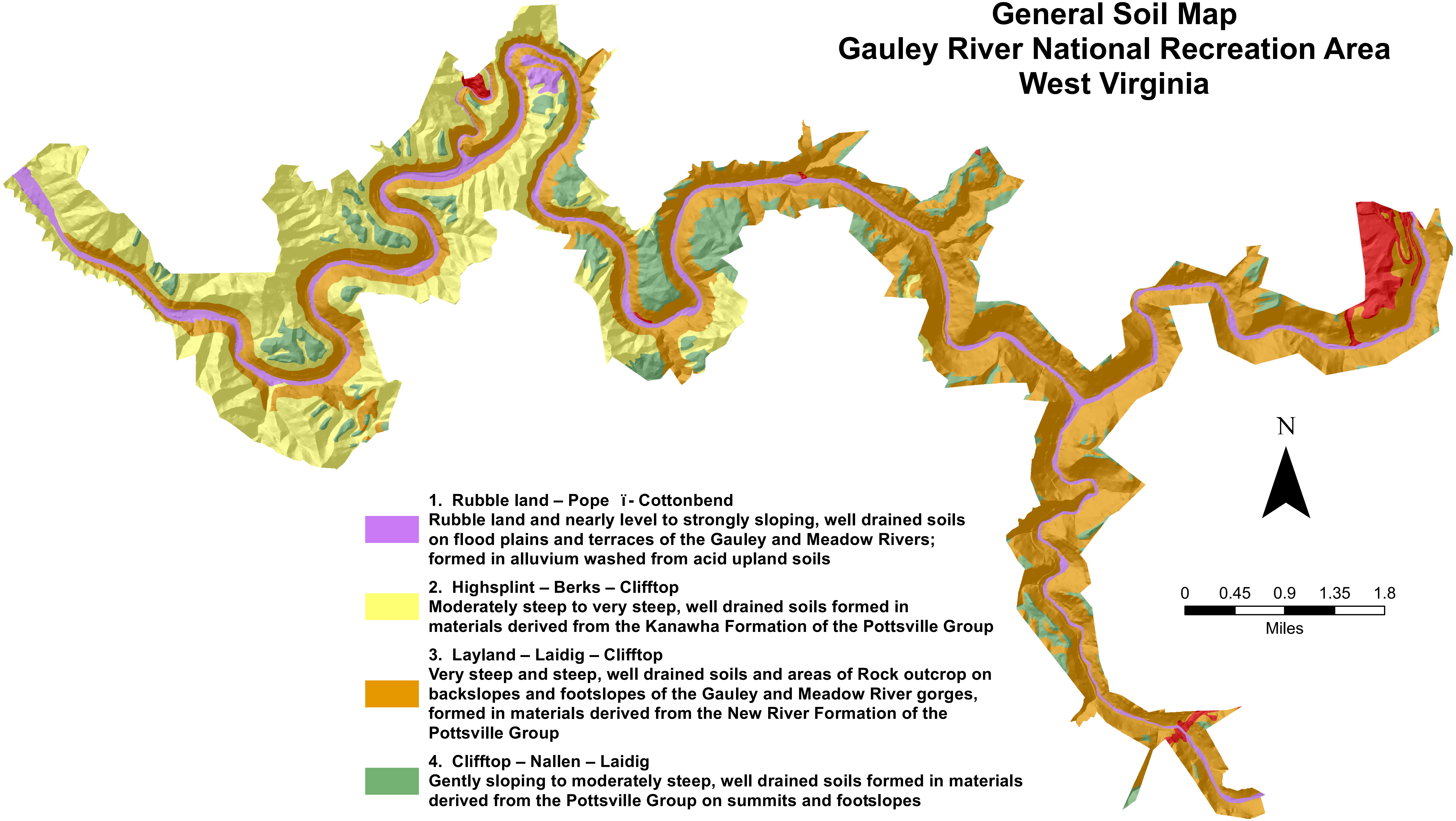
National Park Service
U.S. Department of the Interior

Northeast Region
Natural Resource Stewardship and Science
200 Chestnut Street
Philadelphia, Pennsylvania 19106-2878

http://www.nps.gov/nero/science/


North
0 5 Kilometers
0 5 Miles
National Park Service area
Much of the land within the National Park Service areas remains private property; please respect the owners' rights.
Rapids
The degree of difficulty will vary from rapid to rapid and with water level. River users should consult with an experienced river runner or ranger before attempting river running.
Unpaved road
Picnic area
Campground
Ranger station
Public river access
Primitive campsite
GAULEY RIVER NATIONAL RECREATION AREA
(Rapids named on the Gauley River are Class V and above)
Dixie
Belva
Swiss
Jodie
Peters Junction
Peters Creek
Koontz Flume Rapids
Tunnel
Upper and Lower Mash Rapids
Gauley River
Pure Screaming Hell Rapids
Heaven Help You Rapids
CARNIFEX FERRY BATTLEFIELD STATE PARK
Overlook
Sweets Falls Rapids
Iron Ring Rapids
Lost Paddle Rapids
Pillow Rock Rapids
Insignificant Rapids
Sunday Road
Tunnel
SUMMERSVILLE LAKE WILDLIFE MANAGEMENT AREA
Summersville Airport
Summersville Lake
Summersville Dam
To Summersville and 79
Gauley River
Hominy Creek
Mount Nebo
Gauley Bridge
Kanawha River
To Charleston
HAWKS NEST STATE PARK
Overlook
ANSTED
Victor
Saturday Road
Stringtown Road
Sunday Road
Miller Ridge Road
Meadow River
Hico
CSX Railroad (no trespassing)
Cotton Hill
Hawks Nest Dam
Ames Heights
Canyon Rim Visitor Center
Overlook
Lansing
New River Gorge Bridge
To travel down into the gorge and back up use W.Va. 82; begin in Lansing. For most of the distance between Lansing and Fayetteville the road is one-way, narrow and winding.
Fayette Station Road
FAYETTEVILLE
Fayette Station Rapids
Greyhound Rapids
Millers Folly Rapids
Edmond
Lookout
Double Z Rapids
Dudleys Dip Rapids
Winona
Kaymoor Mine Site
Keeneys Rapids
Wolf Creek
To Montgomery and Charleston
New River
Lower Railroad Rapids
Upper Railroad Rapids
CAMP WASHINGTON CARVER
Clifftop
Manns Creek
Meadow River
Gatewood Road
Cunard
Sewell
OAK HILL
Brooklyn
BABCOCK STATE PARK
Grist Mill
RAINELLE
Minden
To Mossy and 77 64
To Lewisburg and 64
Surprise Rapids
Thurmond
CSX Railroad (no trespassing)
Whipple
Dunglen
Thurmond Historic District
Plum Orchard Lake
PLUM ORCHARD WILDLIFE MANAGEMENT AREA
Dunloup Creek
Stone Cliff
Glen Jean
National River Headquarters
Mckendree Road
Danese
Silo Rapids
Thayer
MOUNT HOPE
Dowdy Cr
Creek
Laurel
Army Camp
Grandview Sandbar
Terry
Prince
Quinnimont
NEW RIVER GORGE NATIONAL RIVER
(Rapids named on the New River are Class III and above)
Meadow Bridge
To Charleston
McCreery
Quinnimont Rapids
Grandview
Overlook
CSX Railroad (no trespassing)
Meadow Creek
To Lewisburg
Toll Road
Piney Creek
Mill Creek
Grassy Shoals Rapids
Glade Creek
New River
Overlook
Meadow Creek
Sandstone Visitor Center
Green Sulphur Spring
Tamarack
Glade Creek
Lick Creek
Harper Rd
Raleigh County Memorial Airport
BECKLEY
Kanawha St
Fayette St
Sandstone Falls (portage river-left)
Sandstone
Overlook
Laurel Creek
Beaver
Daniels
Little Beaver Lake
LITTLE BEAVER STATE PARK
To Twin Falls State Park
River Road
Brooks
Brooks Falls (portage river-left)
Shady Spring
Glade Creek Reservoir
Madam Creek
Toll Road
Piney
Creek
HINTON
CSX Railroad (no trespassing)
To Lewisburg and 64
Greenbrier River
Bellepoint
Bluestone Dam
John Henry Monument
BLUESTONE STATE PARK
Ghent
Flat Top Lake
Little Bluestone River
BLUESTONE LAKE
BLUESTONE NATIONAL SCENIC RIVER
Bluestone River
BLUESTONE WILDLIFE MANAGEMENT AREA
New River
Creek
Indian
Pipestem
CAMP CREEK STATE FOREST
CAMP CREEK STATE PARK
PIPESTEM RESORT STATE PARK
To Bluefield and 81

General Soil Map
Gauley River National Recreation Area
West Virginia



1. Rubble land – Pope ï- Cottonbend
Rubble land and nearly level to strongly sloping, well drained soils on flood plains and terraces of the Gauley and Meadow Rivers; formed in alluvium washed from acid upland soils

2. Highsplint – Berks – Clifftop
Moderately steep to very steep, well drained soils formed in materials derived from the Kanawha Formation of the Pottsville Group

3. Layland – Laidig – Clifftop
Very steep and steep, well drained soils and areas of Rock outcrop on backslopes and footslopes of the Gauley and Meadow River gorges, formed in materials derived from the New River Formation of the Pottsville Group

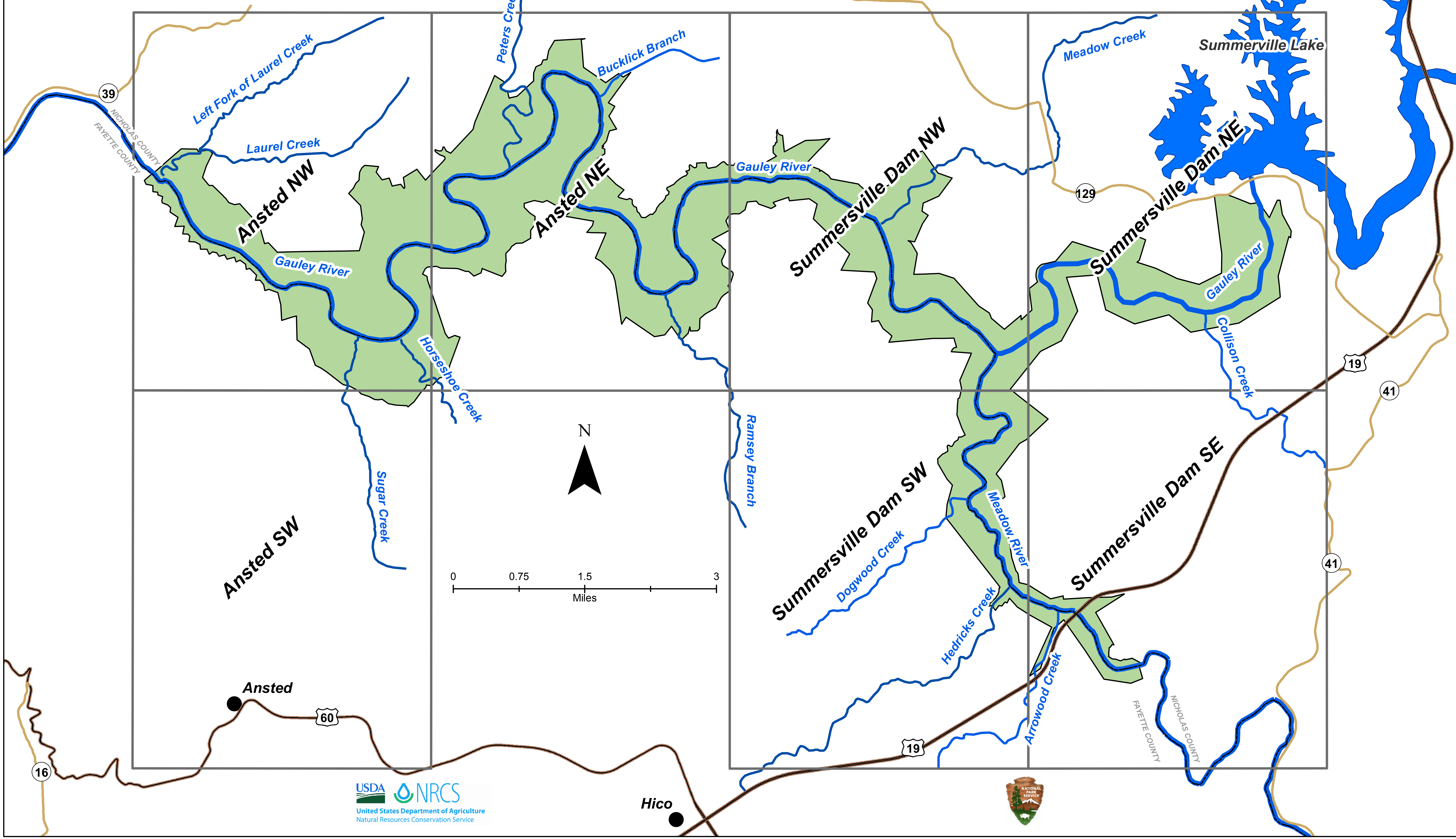
4. Clifftop – Nallen – Laidig
Gently sloping to moderately steep, well drained soils formed in materials derived from the Pottsville Group on summits and footslopes

5. Lithic Udorthents – Udorthents
Nearly level to very steep anthropogenic soils formed in human-transported materials (HTM)

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

NATIONAL PARK SERVICE

INDEX TO MAP SHEETS
Gauley River National Recreation Area
West Virginia



GAULEY RIVER NATIONAL RECREATION AREA, WEST VIRGINIA

SOIL LEGEND

SYMBOL	NAME
AgC	Allegheny loam, 8 to 15 percent slopes
BhG	Berks-Highsplint-Sharondale complex, 35 to 80 percent slopes, very stony
BuC	Buchanan loam, 8 to 15 percent slopes
ClB	Clifftop channery silt loam, 3 to 8 percent slopes
ClC	Clifftop channery silt loam, 8 to 15 percent slopes
ClD	Clifftop channery silt loam, 15 to 25 percent slopes
ClE	Clifftop channery silt loam, 25 to 35 percent slopes
CmC	Clifftop channery silt loam, 3 to 15 percent slopes, very stony
CwB	Cottonbend loam, 3 to 8 percent slopes
CwC	Cottonbend loam, 8 to 15 percent slopes
DkC	Dekalb very channery loam, 3 to 15 percent slopes, extremely stony
DrE	Dekalb-Rock outcrop complex, 15 to 35 percent slopes, extremely stony
FeB	Fenwick silt loam, 3 to 8 percent slopes
FeC	Fenwick silt loam, 8 to 15 percent slopes
HgE	Highsplint channery loam, 15 to 35 percent slopes, very stony
LaC	Laidig channery loam, 3 to 15 percent slopes, rubbly
LbC	Laidig channery loam, 3 to 15 percent slopes, very rubbly
LcE	Laidig-Clifftop complex, 15 to 35 percent slopes, very stony
LdF	Layland-Clifftop complex, 35 to 70 percent slopes, very stony
LhE	Layland-Laidig complex, 15 to 35 percent slopes, rubbly
LkE	Layland-Laidig complex, 15 to 35 percent slopes, very rubbly
LmF	Layland-Rock outcrop complex, 35 to 70 percent slopes, very rubbly
LuC	Lithic Udorthents, leveled land, 0 to 15 percent slopes
LxG	Lithic Udorthents-Rock outcrop complex, cut land, 5 to 100 percent slopes
NaB	Nallen loam, 3 to 8 percent slopes
NaC	Nallen loam, 8 to 15 percent slopes
NaD	Nallen loam, 15 to 25 percent slopes
PsA	Pope sandy loam, 0 to 3 percent slopes, rarely flooded
PvA	Pope-Craigsville complex, 0 to 3 percent slopes, occasionally flooded
Rw	Riverwash, frequently flooded
ThB	Typic Haplorthods, 0 to 8 percent slopes, rubbly, rarely flooded
UgC	Udorthents, graded, 0 to 15 percent slopes
UgF	Udorthents, graded, 15 to 55 percent slopes
Ur	Udorthents, railroad grade
Uu	Udorthents-Urban land complex, highways
W	Water
Wr	Water-Rubble land complex

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES
- National, state, or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park)
- Land grant
- Limit of soil survey (label) and/or denied access area
- Field sheet matchline and neatline
- Previously published survey

OTHER BOUNDARY
- Airport, airfield
- Cemetery
- City/county park

STATE COORDINATE TICK
1 890 000 FEET

LAND DIVISION CORNER
(section and land grants)

GEOGRAPHIC COORDINATE TICK

TRANSPORTATION
- Divided roads
- Other roads
- Trail

ROAD EMBLEMS AND DESIGNATIONS
- Interstate — 173, 79 345
- Federal — 287, 410 224
- State — 52, 52 347
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE

PIPE LINE

FENCE

LEVEES
- Without road
- With road
- With railroad
- Single side slope

DAMS
- Medium or small

LANDFORM FEATURES
- Prominent hill or peak
- Soil sample site

MISCELLANEOUS CULTURAL FEATURES
- Farmstead, house
- Church
- School
- Other religion — Mt Carmel
- Located object — Ranger Station
- Tank — Petroleum
- Lookout tower
- Oil and/or natural gas wells
- Windmill
- Lighthouse

HYDROGRAPHIC FEATURES

STREAMS
- Perennial stream, double line
- Perennial stream, single line
- Intermittent stream
- Drainage end

DRAINAGE AND IRRIGATION
- Double-line canal — CANAL
- Perennial drainage and/or irrigation ditch
- Intermittent drainage and/or irrigation ditch

SMALL LAKES, PONDS, AND RESERVOIRS
- Perennial water
- Miscellaneous water
- Flood pool line — FLOOD POOL LINE

MISCELLANEOUS WATER FEATURES
- Spring
- Well, artesian
- Well, irrigation

SPECIAL SYMBOLS FOR SOIL SURVEY AND SSURGO

SOIL DELINEATIONS AND SYMBOLS — AgC BuC

LANDFORM FEATURES
- Bedrock escarpment
- Other than bedrock escarpment
- Short steep slope
- Gully
- Depression, closed
- Sinkhole
- Borrow pit
- Gravel pit
- Mine or quarry
- Landfill

MISCELLANEOUS SURFACE FEATURES
- Blowout
- Clay spot
- Gravelly spot
- Lava spot
- Marsh or swamp
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip
- Sodic spot
- Spoil area
- Stony spot
- Very stony spot
- Wet spot

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF GAULEY RIVER NATIONAL
RECREATION AREA, WEST VIRGINIA
ANSTED NW QUADRANGLE
SHEET NUMBER 1 OF 7

81°7'30"W 81°5'0"W

38°15'0"N 38°15'0"N

38°12'30"N 38°12'30"N

81°7'30"W 81°5'0"W

Joins sheet 5, Ansted SW

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2007 NAIP aerial photography. Culture and hydro information were acquired from U.S. Geological Survey 7.5-minute quadrangles and other sources.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 17. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

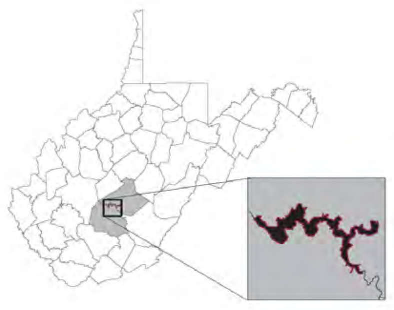
N

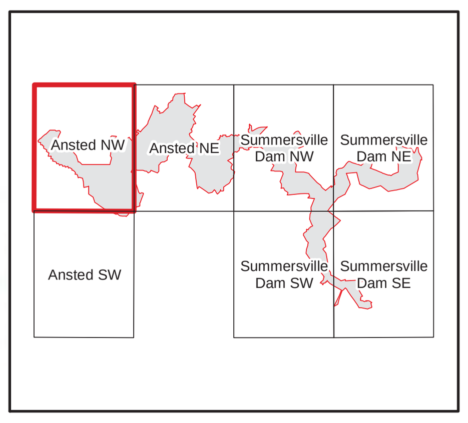
0.5 0.25 0 0.5
Miles

0 0.25 0.5 1
Kilometers

0 1,250 2,500
Feet

SCALE 1:12,000





GAULEY RIVER RECREATION
AREA, WEST VIRGINIA

SHEET 1 OF 7

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SOIL SURVEY OF GAULEY RIVER NATIONAL
RECREATION AREA, WEST VIRGINIA
ANSTED NE QUADRANGLE
SHEET NUMBER 2 OF 7

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service at the request of the Department of Interior, National Park Service. Base maps are orthophotographs prepared by the U.S. Department of Agriculture, Farm Service Agency, from 2007 NAIP aerial photography. Culture and hydro information were acquired from U.S. Geological Survey 7.5-minute quadrangles and other sources.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 17. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

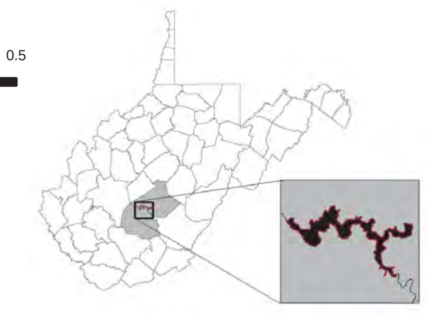
N

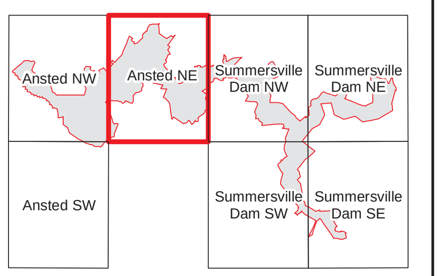
0.5 0.25 0 0.5
Miles

0 0.25 0.5 1
Kilometers

0 1,250 2,500
Feet

SCALE 1:12,000





GAULEY RIVER RECREATION AREA, WEST VIRGINIA

SHEET 2 OF 7

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 17. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

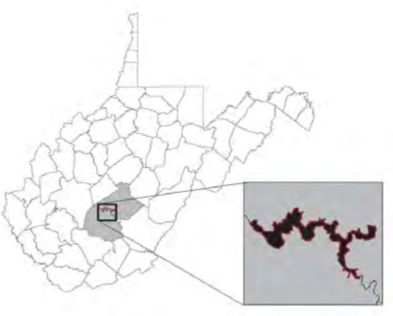
N

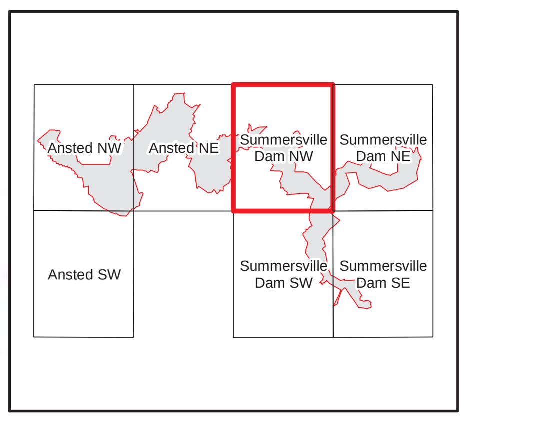
0.5 0.25 0 0.5
Miles

0 0.25 0.5 1
Kilometers

0 1,250 2,500
Feet

SCALE 1:12,000





GAULEY RIVER RECREATION AREA, WEST VIRGINIA

SHEET 3 OF 7

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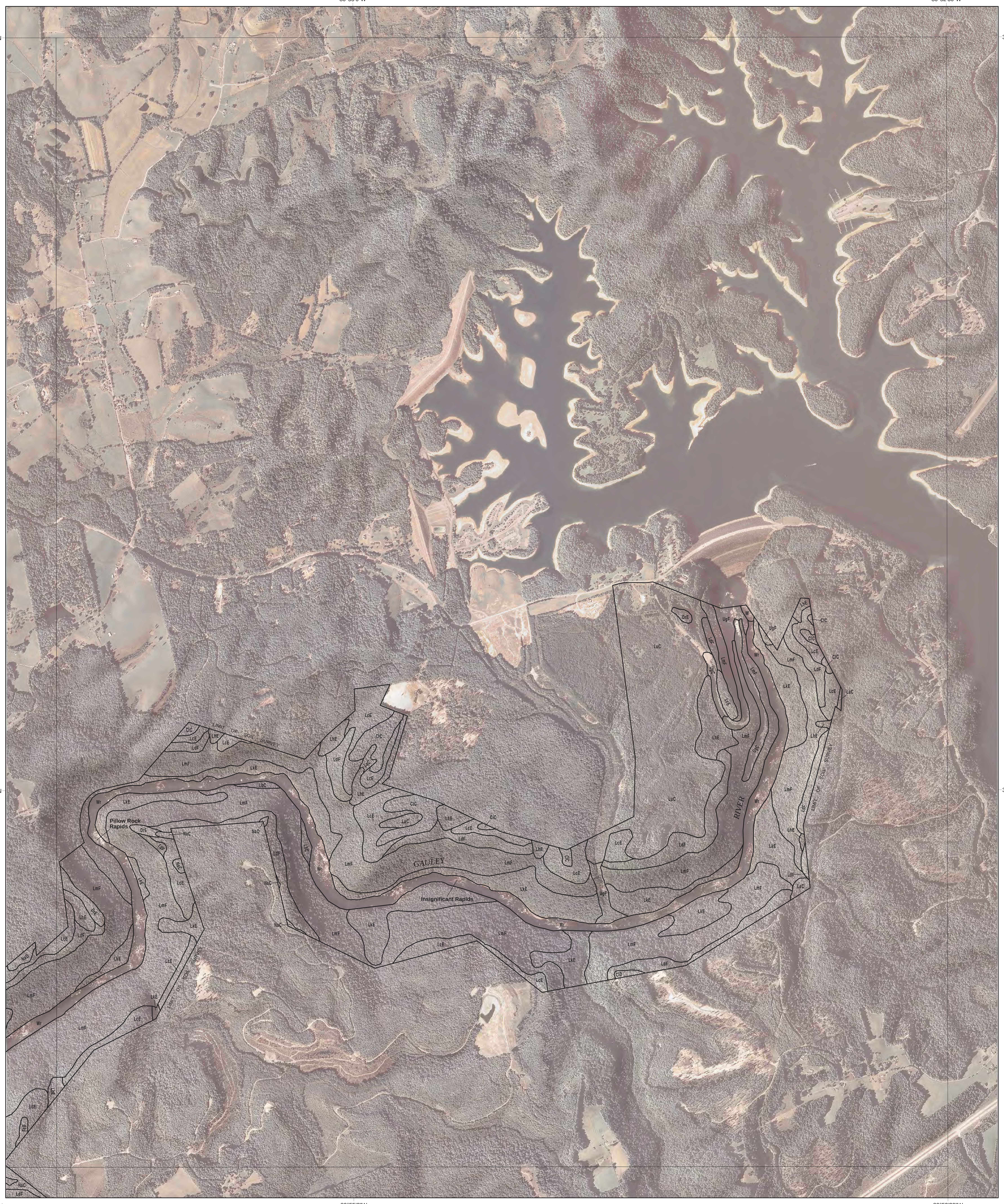
SOIL SURVEY OF GAULEY RIVER NATIONAL
RECREATION AREA, WEST VIRGINIA
SUMMERSVILLE DAM NE QUADRANGLE
SHEET NUMBER 4 OF 7

80°55'0"W 80°52'30"W

38°15'0"N 38°15'0"N

Joins sheet 3, Summersville Dam NW



38°12'30"N 38°12'30"N

80°55'0"W 80°52'30"W

Joins sheet 6, Summersville Dam SW

Joins sheet 7, Summersville Dam SE

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 17. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

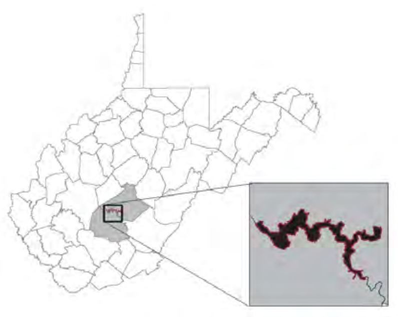
N

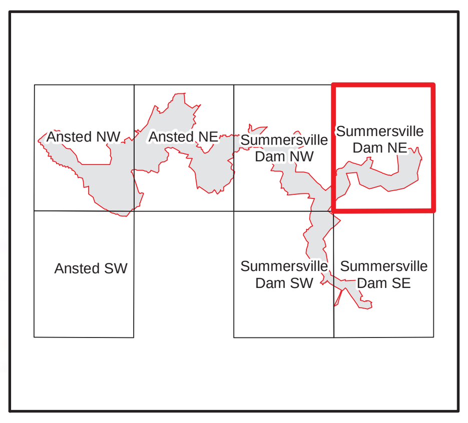
Miles: 0.5 0.25 0 0.5

Kilometers: 0 0.25 0.5 1

Feet: 0 1,250 2,500

SCALE 1:12,000





GAULEY RIVER RECREATION AREA, WEST VIRGINIA

SHEET 4 OF 7

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NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF GAULEY RIVER NATIONAL
RECREATION AREA, WEST VIRGINIA
ANSTED SW QUADRANGLE
SHEET NUMBER 5 OF 7

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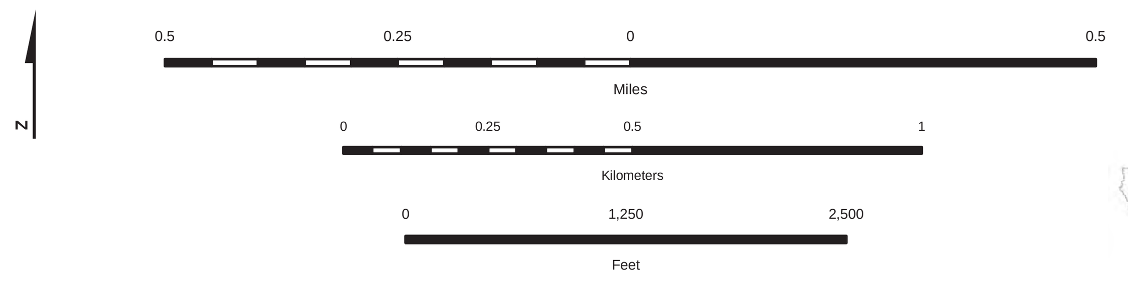
North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 17. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



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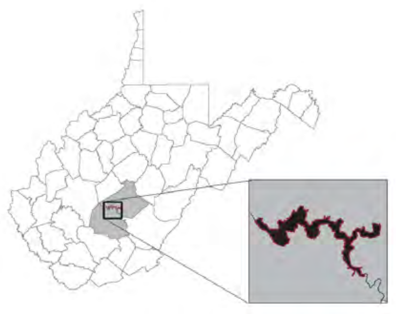

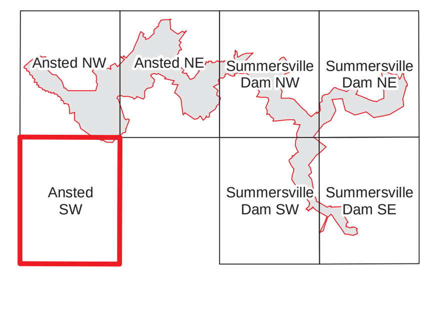

GAULEY RIVER RECREATION AREA, WEST VIRGINIA

SHEET 5 OF 7

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SOIL SURVEY OF GAULEY RIVER NATIONAL
RECREATION AREA, WEST VIRGINIA
SUMMERSVILLE DAM SW QUADRANGLE
SHEET NUMBER 6 OF 7

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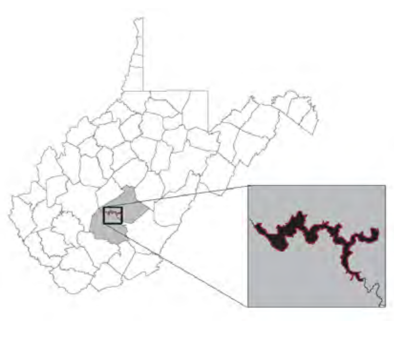
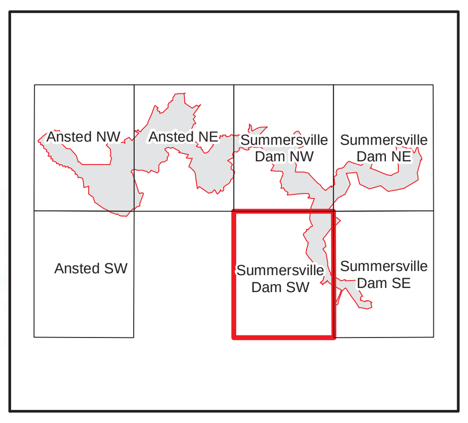
North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 17. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

N

0.5 0.25 0 0.5
Miles
0 0.25 0.5 1
Kilometers
0 1,250 2,500
Feet

SCALE 1:12,000





GAULEY RIVER RECREATION
AREA, WEST VIRGINIA

SHEET 6 OF 7

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NATURAL RESOURCES CONSERVATION SERVICE

SOIL SURVEY OF GAULEY RIVER NATIONAL RECREATION AREA, WEST VIRGINIA
SUMMERSVILLE DAM SE QUADRANGLE
SHEET NUMBER 7 OF 7

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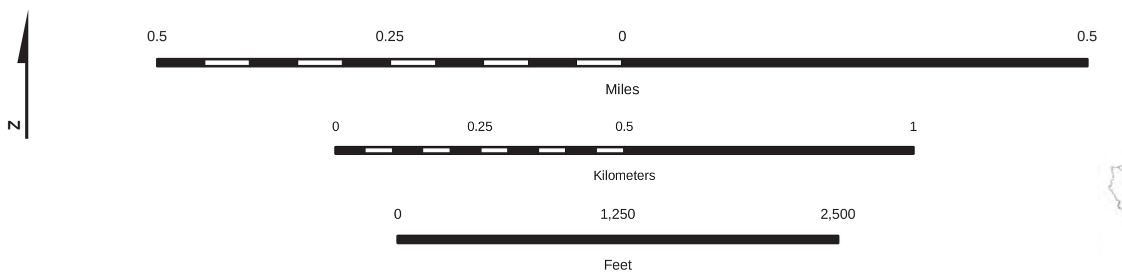
North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 17. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



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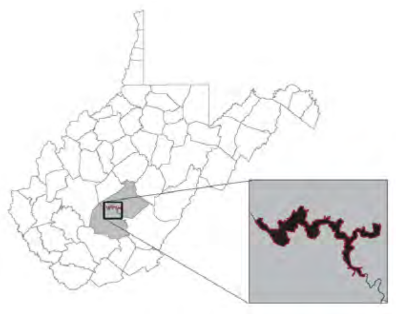

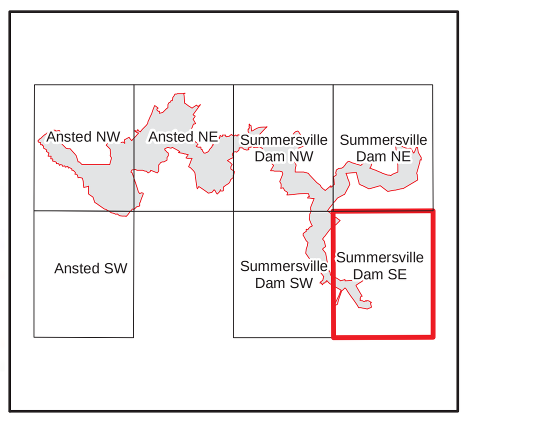

GAULEY RIVER RECREATION AREA, WEST VIRGINIA

SHEET 7 OF 7

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